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NATIONAL SOIL TAXONOMY HANDBOOK  
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SUBJECT: SOI - REVISED NATIONAL SOIL TAXONOMY HANDBOOK

Purpose: To distribute amended pages to the Soil Taxonomy which is now filed within the National Soil Survey Handbook.

Effective Date: These amendments and revisions are effective when received.

Filing instructions: National Soil Taxonomy Handbook Issues Nos. 1 through 16 are now apart of the National Soil Survey Handbook Part 615. This issue should be filed as follows:

File page iii "Contents" following page ii. Replace pages vii and viii of "Index to pages of Soil Taxonomy" dated August 1992 with the attached pages vii through x of the index dated April 1994. File pages 615-605 to 615-662 following pages 615-604.

Supplementation: States and NTC's may not supplement the handbook.

ROBERT R. SHAW  
Deputy Chief for Technology

Attachments



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**615.112 Strongly contrasting particle-size classes**

NSTH 615.60, p. 615-207, Strongly contrasting particle-size classes (*Soil Taxonomy* p. 385). Renumber items 1-6 as 2-7 and 7-53 as 9-55, and add new items 1 and 8 to read as follows:

"1. Ashy over clayey.

8. Ashy-skeletal over fragmental or cindery if the volume of the fine-earth fraction is 35 percent or more (absolute) greater in the ashy-skeletal part than in the fragmental or cindery part."

NSTH 615.60, page 207, Strongly contrasting particle-size classes (*Soil Taxonomy* p. 385). Change new items 17 (put in alphabetical order and correct numbering), 25, 38, and 39 to read as follows:

"17. Clayey-skeletal over sandy or sandy-skeletal.

25. Loamy over pumiceous or cindery.

38. Loamy-skeletal over fragmental if the volume of the fine-earth fraction is 35 percent or more (absolute) greater in the loamy-skeletal part than in the fragmental part.

39. Loamy-skeletal over sandy or sandy-skeletal if the loamy material has less than 50 percent fine or coarser sand."

**615.113 Sloping families**

Slope, or shape of slope, has been used as a family differentia for soils of certain aquic great groups. The differentia is not clearly defined, and as a result has been ignored or used inconsistently. The original intent in recognizing sloping families was to identify differences in the difficulty of removing excess water. Thirteen series in the United States are classified in sloping families. The slope range for these series often overlaps with similar series which are classified the same above the family level, but are not in a sloping family. A cursory check of soil series in aquic great groups reveals that there are series in the data base that should be in a sloping family, but are not. This inconsistent use of the sloping-family criterion has resulted in meaningless separations, and the criterion is therefore deleted.

Page 383, Family differentiae for mineral soils. Delete "Soil slope classes" from list.

Page 388, Other characteristics. In last line, delete "slope of soil, ".

**615.115 Aridisol amendment<sup>1</sup>**Introduction

than 50 percent is destroyed by soaking in concentrated alkali, either as a single treatment or by alternating treatments with acid. The presence of a thin continuous layer of opal, that is insoluble in acid, indicates enough cementation by silica to satisfy the requirements of a

requirements of a fragipan if more than 50 percent of dry pan fragments slake when placed in water.

#### Summary of properties

The duripan is a silica-cemented subsurface horizon with or without auxiliary cementing agents. A duripan can occur in conjunction with a petrocalcic horizon.

A duripan must meet all of the following requirements:

1. Is cemented or indurated in more than 50 percent of the volume of some horizon; and
2. Has evidence of accumulation of opal or other forms of silica as laminar capping, coatings, lenses, partly filled interstices, bridges between sand-size grains, or coatings on rock fragments; and
3. Less than 50 percent of the volume slakes in 1N HCl even during prolonged soaking, but more than 50 percent slakes in concentrated KOH, NaOH, or in alternating acid and alkali; and
4. Has lateral continuity such that roots cannot penetrate except along vertical fractures, which have a horizontal spacing of 10 cm or more."

Page 45, left column. Delete the section entitled "Calcic horizon and ca horizon" and replace with the following:

#### **"Calcic horizon**

The calcic horizon is an illuvial horizon in which secondary calcium carbonate, or other carbonates have accumulated to a significant extent. It may occur in conjunction with various other horizons such as a mollic epipedon, an argillic or a natric horizon.

Commonly, a calcic horizon has developed in unconsolidated materials of more or less mixed mineralogical composition. The secondary calcium carbonate generally is easy to recognize because it occurs as a white, powdery filling, as concretions, or as pendants or crusts below pebbles and stones. In such situations, the horizon is considered a calcic horizon if the carbonate content ( $\text{CaCO}_3$  equivalent) of a layer 15 cm or more thick exceeds 15 percent by weight (5 percent if the soil is less than 18 percent clay and has a sandy, sandy-skeletal, coarse-loamy, or loamy-skeletal particle size class) and the layer has at least 5 percent more  $\text{CaCO}_3$  equivalent than an underlying layer.

Limestones and marls are formed by precipitation of calcium carbonate or of calcium and magnesium carbonates in water and may appear similar to calcic horizons. A calcic horizon formed on limestone or in marl may be difficult to identify. The most useful diagnostic feature for recognition of the calcic horizon in such situations is the presence of a layer that contains powdery calcium carbonate, concretions, or laminar pendants on the lower sides of limestone fragments. If the percentage, by volume, of redeposited (authigenic) calcium carbonate exceeds 5 percent in a layer 15 cm or more thick, the horizon should be considered a calcic horizon.

Some parts of a calcic horizon may be cemented or indurated, though typically air-dry fragments of a calcic horizon will slake in water, except for disconnected carbonate concretions and pendants under rock fragments. If a horizon with secondary carbonates is indurated or cemented to such a degree that it meets the requirements of a petrocalcic horizon, it is considered a petrocalcic horizon (defined below). Plate 6C shows a soil that has a calcic horizon between a depth of about 20 and 100 cm.

The genetic implications of a calcic horizon are variable. In arid regions, if the parent materials contain considerable amounts of calcium, the very limited rainfall seems insufficient to completely remove calcium carbonate from even the surface few centimeters. About the only significant horizon that can develop in such a soil is a calcic horizon. Pedon 36 illustrates

such a situation. In this soil the calcic horizon extends from a depth of 10 to 58 cm.

In some soils in semiarid regions, a mollic epipedon may develop in addition to a calcic horizon. Apparently, no other horizons ordinarily develop. Pedon 37 illustrates such a soil. The mollic epipedon is 38 cm thick, and it rests on a calcic horizon that extends to a depth of 145 cm.

Some soils in semiarid regions have a calcic horizon above and in an argillic horizon. It is presumed that the argillic horizon developed under a climate wetter than the present one. These soils are receiving carbonates from eolian sources, and a calcic horizon is now forming at a relatively shallow depth. In such situations, the calcic horizon is presumed to start where the identifiable secondary carbonates amount to 5 percent or more by volume, and the  $\text{CaCO}_3$  equivalent exceeds 15 percent if the soil is more than 18 percent clay.

In soils that have, near the surface, ground water that contains an appreciable amount of calcium bicarbonate, the capillary rise and the evaporation plus transpiration cause precipitation of a large amount of calcium carbonate. Depending on the depth from the surface to the capillary fringe, the top of the zone of calcium carbonate accumulation may be from the surface to a depth of about 60 cm. In such soils, the accumulation of calcium carbonate is comparable to the accumulation of more soluble salts in desert playas. Pedon 38 is a soil that has such a calcic horizon in the upper 46 cm of the soil. The calcic horizon in this soil is also a mollic epipedon. Depending on the position of the water table, such soils may occupy depressions. If water was ponded, a soil that has a calcic horizon commonly forms a circular outline around the deeper depressions and can also occur on micro high elevations in the depressions.

In the situations just discussed, one might attach a high genetic significance to a calcic horizon. In some other circumstances, however, one can attach little genetic significance to the absolute amount of carbonates in a horizon or layer of carbonate accumulation. Deposition from ground water at a depth of 3 m or more is more nearly a geologic than a pedologic process. In soils formed from calcareous materials on the steppes, the amount of calcium carbonate in horizons that contain secondary calcium carbonate is a partial function of the amount of calcium carbonate in the parent materials.

Pedon 5 is typical of a soil in which there is a calcic horizon of little genetic significance. The mollic epipedon and the natric horizon are significant to the classification of this soil. The presence of a horizon that has secondary carbonates is significant, but the absolute amount of calcium carbonate in that horizon depends on both the amount of secondary carbonates and the amount of carbonates in the parent material.

The calcic horizon has all of the following properties:

1. Is 15 cm or more thick; and
2. Is not indurated or cemented to such a degree that it meets the requirements of a petrocalcic horizon; and
3. Has one or more of the following:
  - a. Fifteen percent or more  $\text{CaCO}_3$  equivalent, (see below) and its  $\text{CaCO}_3$  equivalent is 5 percent or more (absolute) higher than that of an underlying horizon; or
  - b. Fifteen percent or more  $\text{CaCO}_3$  equivalent, and 5 percent or more (by volume) identifiable secondary carbonates; or
  - c. Five percent or more calcium carbonate equivalent and has:
    - (1). Less than 18 percent clay in the fine-earth fraction; and

(2). A particle size that is sandy, sandy-skeletal, coarse-loamy, or loamy-skeletal; and

(3). A weight of identifiable secondary carbonates, that is 5 percent or more (absolute) higher than that of an underlying horizon."

Page 46, Left column. Delete section under "Gypsic horizon" and replace with the following:

**"Gypsic horizon**

The gypsic horizon is an illuvial horizon in which secondary gypsum has accumulated to a significant extent.

A gypsic horizon has all of the following properties:

1. Is 15 cm or more thick; and
2. Is not cemented or indurated to such a degree that it meets the requirements of a petrogypsic horizon; and
3. Is 5 percent or more gypsum and is 1 percent or more by volume secondary visible gypsum; and
4. Has a product of thickness in centimeters multiplied by gypsum content percentage of 150 or more.

Thus, a horizon 30 cm thick that is 5 percent gypsum qualifies as a gypsic horizon if it is 1 percent or more by volume visible gypsum and is not cemented or indurated to such a degree that it meets the requirements of a petrogypsic horizon.

The gypsum percentage can be calculated by multiplying the milliequivalents of gypsum per 100 g soil by the milliequivalent weight of  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ , which is 0.086.

Gypsum may accumulate uniformly throughout a matrix of sand and finer textured material or as nests of crystals. In gravelly or stony material it may accumulate in pendants below the pebbles or stones.

Pedon 39 illustrates a gypsic horizon. In this soil there is a calcic horizon between a depth of 13 cm and 56 cm

firmer when moist. Its saturated hydraulic conductivity is commonly moderately low to very low unless the horizon is fractured.

A laminar cap may be present but is not required. If one is present, carbonates normally constitute half or more by weight of the laminar horizon. Gravel, sand, and silt grains have been separated by the crystallization of carbonates in at least parts of the laminar subhorizon. Figure 3 shows a slice through the upper 13 cm of a petrocalcic horizon. Sand and gravel have been largely pushed aside by crystallization of calcium carbonate at the surface of the laminar horizon. Radiocarbon dates of the organic and inorganic carbon indicate that this laminar horizon is late Wisconsinan to Holocene in age and that the cementation of the underlying gravel took place during the late Pleistocene.

Pedon 40 illustrates a soil that has a petrocalcic horizon. The petrocalcic horizon lies between a depth of 28 cm and 64 cm. Plate 10D shows a soil with a petrocalcic horizon that has its upper boundary at a depth of about 70 cm and its lower boundary at a depth of about 150 cm.

A petrocalcic horizon must meet the following requirements:

1. It is cemented or indurated by carbonates with or without silica or other cementing agents; and
2. Has a lateral continuity such that roots cannot penetrate except along vertical fractures, which have a horizontal spacing of 10 cm or more; and
3. Has a thickness of:
  - a. 10 cm or more; or
  - b. 1 cm or more if it consists of a laminar capping directly underlain by bedrock."

Page 47, left column. Delete section under "Petrogypsic horizon" and replace with the following:

**"Petrogypsic horizon**

The petrogypsic horizon is an illuvial horizon 10 cm or more thick in which secondary gypsum has accumulated to the extent that the horizon is cemented or indurated. Dry fragments do not slake in water and roots cannot enter except in vertical fractures which have a

Much of the salt is commonly halite, the crystalline form of sodium chloride. In some areas, soluble sulfates may also accumulate with the crystalline forms such as thenardite, hexahydrite, epsomite, and mirabilite. Some of the commonly occurring bicarbonates are trona and natron. Under extreme aridic conditions and at low temperatures, evaporites of calcium chloride, nitrates, and other soluble salts may accumulate. Identification of the kinds of crystalline salts requires detailed mineralogical analyses.

A salic horizon is 15 cm or more thick and has for 90 consecutive days or more per year, in 6 or more years out of 10:

1. An electrical conductivity (EC) equal to or greater than 30 ds/m in a 1:1 soil : water extract; and
2. The product of the EC in ds/m and thickness in cm equal 900 or more."

Page 51, right column. Delete section under "Soft powdery lime" and replace with the following:

**"Identifiable Secondary Carbonates**

Identifiable secondary carbonates is a term used in the definitions of a number of taxa. It refers to translocated authigenic calcium carbonate that has been precipitated in place from the soil solution rather than inherited from parent material such as a calcareous layer or till.

**2. Have**

- a. A salic horizon; and
- b. Saturation with water in one or more layers within 100 cm of the soil surface for 1 month or more per year in 6 out of 10 years; and
- c. No sulfuric horizon that has its upper boundary within 150 cm of the mineral soil surface.

**Aridisols"**

Page 95, right column, Definition of Alfisols. Replace item 2 with the following:

- "2. Do not have an aridic soil moisture regime nor a salic horizon and saturation with water in one or more layers within 100 cm of the soil surface for 1 month or more per year in 6 out of 10 years."

Page 96, left column, Limits between Alfisols and soils of other orders. Replace item 2 (refer to NSTH page 615-179) to read as follows:

- "2. To distinguish Alfisols from Aridisols, Alfisols do not have:

- a. An aridic moisture regime and;

- b. Both a salic horizon and saturation with water for 1 month or more per year in 6 out of 10 years."

Page 144, left column, lines 25. Change "Calciorthids" to "Calciargids"

Page 144, left column, left column, line 27 delete "or that is aridic"

Page 144, left column, line 45. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

Page 144, left column, line 58. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

moisture regimes are used at the suborder level or lower categories but in the Order of Aridisols, it is used to define the Order category. This produces a rather homogeneous class defined by a limited number of processes and this also eliminates a number of other processes or these processes have a minimal expression in such soils. As the soil moisture regime is also the single most important constraint in the utilization of these soils, this Order delineates geographic areas based on this constraint.

Having employed the major control of processes at the Order level, it provides the facility to use other

1. Have an aridic soil moisture regime or a salic horizon and saturation with water in one or more layers within 100 cm of the soil surface for 1 month or more per year in 6 out of 10 years; and

2. Have an ochric or anthropic epipedon and one or more of the following with an upper boundary within 100 cm of the soil surface: an argillic, calcic, cambic, gypsic, natric, petrocalcic, petrogypsic, or a salic horizon, or a duripan;

3. Do not have a spodic horizon, nor an Ap horizon consisting of spodic materials;

4. Do not have andic soil properties in 60 percent or more of the thickness between either the mineral soil surface, or the top of an organic layer with andic soil properties, whichever is shallower, and a depth of 60 cm or a lithic or paralithic contact, duripan, or petrocalcic horizon, whichever is shallower;

5. Within 150 cm of the mineral surface have neither an oxic horizon, nor a kandic horizon that meets the weatherable-mineral requirements for an oxic horizon and also 40 percent or more clay in the surface 18 cm after mixing;

6. Do not have all of the following:

a. A layer 25 cm or more thick, with an upper boundary within 100 cm of the mineral surface, that either has slickensides close enough to intersect or wedge-shaped aggregates which have their long axes tilted 10 to 60 degrees from the horizontal; and

b. A weighted average of 30 percent or more clay in the fine-earth fraction either between the mineral soil surface and a depth of 18 cm or an Ap horizon, whichever is thicker, and 30 percent or more clay in the fine-earth fraction of all horizons between a depth of 18 cm and either a depth of 50 cm, or a lithic or paralithic contact, duripan, or petrocalcic horizon if shallower; and

c. Open cracks in some or most years.

#### Key to suborders

FA. Aridisols that have a cryic soil temperature regime.  
Cryids

FB. Other Aridisols which have a salic horizon that has its upper boundary within 100 cm of the soil surface.  
Salids

FC. Other Aridisols which have a duripan that has its upper boundary within 100 cm of the soil surface.

FD. Other Aridisols which have a gypsic or petrogypsic horizon that has its upper boundary within 100 cm of the soil surface and lack a petrocalcic horizon overlying any of these horizons.  
Gypsid

FE. Other Aridisols which have an argillic or natric horizon that has its upper boundary within 100 cm of the soil surface and do not have a petrocalcic horizon that has an upper boundary within 100 cm of the soil surface.  
Argids

FF. Other Aridisols which have a calcic or petrocalcic horizon that has its upper boundary within 100 cm of the soil surface.  
Calcids

FG. Other Aridisols.  
Cambids

#### Argids

These are the Aridisols that have an argillic or natric horizon, but not a duripan, gypsic, petrocalcic,

petrogypsic, or salic horizon within 100 cm of the soil surface. The low water flux and high concentration of salts in many Aridisols hinders clay illuviation. The presence of an argillic horizon is often attributed to a moister paleo-climate, although there is evidence that clay illuviation has occurred during the Holocene in arid soils. Where the soil moisture regime grades to ustic or xeric, evidence of clay translocation is often more readily established.

#### Definition

Argids are the Aridisols which:

1. Have a natric or argillic horizon that has its upper boundary within 100 cm of the soil surface;

2. Have a soil temperature regime warmer than cryic;

3. Do not have a duripan or gypsic, petrocalcic, petrogypsic or salic horizon that has its upper boundary within 100 cm of the soil surface.

#### Argids

Key to great groups

FEA. Argids which have a duripan or a petrocalcic or petrogypsic horizon that has its upper boundary within 150 cm of the soil surface.

Petroargids

FEB. Other Argids that have a natric horizon.

Natrargids

FEC. Other Argids which do not have a lithic or paralithic contact within 50 cm of the soil surface, and have either:

1. A clay increase of 15 percent or more (absolute) within a vertical distance of 2.5 cm either within the argillic horizon or at its upper boundary; or

2. An argillic horizon that extends to 150 cm or more from the soil surface, that does not have a clay decrease with increasing depth of 20 percent or more (relative) from the maximum clay content, and has, in 50 percent or more of the matrix, in some part between 100 and 150 cm either:

a. Hues of 7.5YR or redder and chroma of 5 or more; or

b. Hues of 7.5YR or redder and value, moist, that is 3 or less and value, dry, that is 4 or less.  
Paleargids

FED. Other Argids which have a gypsic horizon that has its upper boundary within 150 cm of the soil

#### Gypsiargids

FEE. Other Argids which have a calcic horizon that has its upper boundary within 150 cm of the soil surface.  
Calciargids

FEF. Other Argids.

Haplargids

#### Calciargids

These are the Argids that have a calcic horizon below the argillic horizon, but within 150 cm of the soil surface. These soils have been recharged with calcium carbonate from dust. The Calciargids are commonly on late-Pleistocene erosional surfaces or sediments that have gentle to steep slopes.

#### Definition

Calciargids are the Argids which:

1. Have a calcic horizon that has its upper boundary within 150 of the soil surface;

2. Do not have a natric horizon;

3. Do not have a duripan or gypsic, petrocalcic, or petrogypsic horizon that has its upper boundary within 150 cm of the soil surface;

4. Have a lithic or paralithic contact within 50 cm of the soil surface or:

a. A clay increase of less than 15 percent (absolute) within a vertical distance of 2.5 cm either within the argillic horizon or at its upper

more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the soil surface; or

2. A linear extensibility of 6.0 cm or more between the soil surface and either a depth of 100 cm or to a lithic or paralithic contact, if shallower.

**Vertic Calcargids**

FEEE. Other Calcargids that are either:

1. Indicated and have acidic conditions for some

b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of

b. A linear extensibility of less than 6.0 cm between the soil surface and either a depth of 100 cm or a lithic or paralithic contact

FEDC. Other Gypsiargids that have *both*:

1. A *typical* central section that is *dry* in all parts.

4. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *either* of the following:

1. A lithic contact within 50 cm of the soil surface;  
and

2. A moisture control section that is dry in all parts  
for less than three-fourths of the time (cumulative)  
when the soil temperature is 5°C or higher at a  
depth of 50 cm and the moisture regime borders on  
an ustic regime.

FEFI. Other Haplargids which have:

1. A sandy particle size throughout a layer  
extending from the soil surface to the top of an  
argillic horizon at a depth of 50 cm or more; and

2. A moisture control section that is dry in all parts  
for less than three-fourths of the time (cumulative)

1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### Vitrandid Haplargids

FEFP. Other Haplargids that are dry in all parts of the moisture control section less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the moisture regime borders a xeric regime.

#### Xeric Haplargids

FEFQ. Other Haplargids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

#### Ustic Haplargids

FEFR. Other Haplargids.

#### Typic Haplargids

#### Definition of Typic Haplargids

Typic Haplargids are the Haplargids which:

1. Do not have a lithic contact within 50 cm of the soil surface;
2. Have an argillic horizon that is continuous throughout each pedon;
3. Have a moisture control section that is dry in all

#### Natrargids

These are the Argids that have a natric horizon, but do not have a duripan or petrocalcic or petrogypsic horizon within 150 cm of the soil surface. Often the natric horizon has prismatic or columnar structure. Natrargids commonly have carbonates, soluble salts, or both. These soils have formed in sediments that range in age from the Holocene to the late-Pleistocene. Most of them are nearly level to gently sloping. These soils occur in western states and the western edge of the Great Plains.

#### Definition of Natrargids

Natrargids are the Argids which:

1. Have a natric horizon;
2. Do not have a duripan or petrocalcic or petrogypsic horizon that has its upper boundary within 150 cm of the soil surface.

#### Key to subgroups

FEBA. Natrargids which have both of the following:

1. A lithic contact within 50 cm of the soil surface; and
2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a

durinodes or are brittle and have at least a firm rupture resistance class when moist; and

2. Are dry in all parts of the moisture control

b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by

5. Are dry in all parts of the moisture control section for three-fourths of the time (cumulative) or more when the soil temperature is 5°C or higher at a depth of 50 cm or do not have a moisture regime that borders an ustic or a xeric regime;

6. Have skeletons covering less than 10 percent of the surfaces of peds at a depth 2.5 cm or more below the upper boundary of the natric horizon;

7. Have an exchangeable sodium percentage of 15 or more (or a sodium adsorption ratio of 13 or more) in more than 50 percent of the natric horizon;

8. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either of the following:

a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*

b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### **Paleargids**

These are the Argids on stable land surfaces that have an abrupt textural change or a clay distribution that does not decrease significantly. Most formed in sediments appreciably older than late-Pleistocene. If calcareous dust is present, some of these soils may be calcareous in all horizons. Slopes are normally gentle.

#### **Definition of Paleargids**

Paleargids are the Argids which:

1. Do not have a lithic or paralithic contact within 50 cm of the soil surface and that have either:

a. A clay increase of 15 percent or more (absolute) within a vertical distance of 2.5 cm either within the argillic horizon or at its upper boundary; *or*

b. An argillic horizon that extends to 150 cm or more from the soil surface, that does not have a clay decrease with increasing depth of 20 percent or more (relative) from the maximum clay content and has, in 50 percent or more of the matrix, in some part between 100 and 150 cm either:

(1). Hues of 7.5YR or redder and chroma of 5 or more; *or*

(2). Hues of 7.5YR or redder and value, moist, that is 3 or less and value, dry, that is 4 or less; *and*

2. Do not have a duripan or petrocalcic or petrogypsic horizon that has its upper boundary within 150 cm of the soil surface; *and*

3. Do not have a natric horizon.

#### **Key to subgroups**

**FECA.** Paleargids that have one or both of the following:

1. Cracks within 125 cm of the soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, slickensides, or wedge-shaped aggregates, in a layer 15 cm or more thick that has its upper boundary within 125 cm of the soil surface; *or*

2. A linear extensibility of 6.0 cm or more between the soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower.

#### **Vertic Paleargids**

**FECB.** Other Paleargids that are either:

1. Irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; *or*

2. Saturated with water, in one or more layers within 100 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years.

#### **Aquic Paleargids**

**FECC.** Other Paleargids that have:

1. A sandy particle size throughout a layer extending from the mineral soil surface to the top of an argillic horizon at a depth of 50 cm or more; *and*

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

#### **Arenic Ustic Paleargids**

**FECD.** Other Paleargids that have a sandy particle size throughout a layer extending from the mineral soil surface to the top of an argillic horizon at a depth of 50 cm or more.

#### **Arenic Paleargids**

**FECE.** Other Paleargids which have a calcic horizon that has its upper boundary within 150 cm of the soil surface.

#### **Calcic Paleargids**

**FECF.** Other Paleargids that have:

1. One or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) durinodes or are brittle and have at least a firm rupture resistance class when moist; *and*

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

#### **Durinodic Xeric Paleargids**

**FECH.** Other Paleargids that have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) durinodes or are brittle and have at least a firm rupture resistance class when moist.

#### **Durinodic Paleargids**

**FECH.** Other Paleargids which have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) nodules or concretions.

#### **Petronodic Paleargids**

**FECI.** Other Paleargids that have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *and*

2. Throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:

a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*

b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### Vitrixerandic Paleargids

FECJ. Other Paleargids that have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:

1. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*
2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### Vitrandidic Paleargids

FECK. Other Paleargids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

percent or more (by volume) durinodes, nodules, or concretions or are brittle and have at least firm rupture resistance class when moist;

7. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either of the following:

a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*

b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### Petroargids

These are the Argids which have a duripan or a petrocalcic or petrogypsic horizon that has its upper boundary between 100 and 150 cm of the soil surface. These soils occur on stable landscapes in the western United States.

#### Definition of Petroargids

These are the Argids which have a duripan or a

Definition of Typic Petroargids

Typic Petroargids are the Petroargids which:

1. Have a petrocalcic horizon that has its upper boundary within 150 cm of the soil surface;
2. Are dry in all parts of the moisture control section for three-fourths of the time (cumulative) or more when the soil temperature is 5°C or higher at a depth of 50 cm or the moisture regime does not border an ustic or a xeric regime;
3. Do not have a duripan or a petrogypsic horizon that has its upper boundary within 150 cm of the soil surface.

**Calcids**

Calcids are the Aridisols that have calcium carbonate in the parent materials or added as dust or both. Precipitation is insufficient to leach or even move the carbonates to great depths. The upper boundary of the

depth of 50 cm and the moisture regime borders a xeric regime.

**Lithic Xeric Haplocalcids**

FFCB. Other Haplocalcids that have:

1. A lithic contact within 50 cm of the soil surface; and
2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

**Lithic Ustic Haplocalcids**

FFCC. Other Haplocalcids that have a lithic contact within 50 cm of the soil surface.

**Lithic Haplocalcids**

FFCD. Other Haplocalcids that have:

1. Cracks within 125 cm of the soil surface that are

durinodes or are brittle and have at least a firm rupture resistance class when moist; and

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

#### **Durinodic Xeric Haplocalcids**

FFCK. Other Haplocalcids that have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) durinodes or are brittle and have at least a firm rupture resistance class when moist.

#### **Durinodic Haplocalcids**

FFCL. Other Haplocalcids which have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) nodules or concretions.

#### **Petronodic Haplocalcids**

FFCM. Other Haplocalcids that have both:

1. A horizon at least 25 cm thick within 100 cm of the soil surface, which has an exchangeable sodium percentage of 15 or more (or an SAR of 13 or more) during at least one month of the year in six or more years out of ten; and

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the moisture regime borders a xeric regime.

#### **Sodic Xeric Haplocalcids**

FFCN. Other Haplocalcids that have both:

1. A horizon at least 25 cm thick within 100 cm of the soil surface, which has an exchangeable sodium percentage of 15 or more (or an SAR of 13 or more) during at least one month of the year in six or more years out of ten; and

2. Other Haplocalcids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the soil moisture regime borders an ustic regime.

#### **Sodic Ustic Haplocalcids**

FFCO. Other Haplocalcids that have, in one or more horizons within 100 cm of the mineral surface, an exchangeable sodium percentage of 15 or more (or a sodium adsorption ratio of 13 or more) for 6 or more months per year in 6 or more out of 10 years.

#### **Sodic Haplocalcids**

FFCP. Other Haplocalcids that have both:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; and

2. Throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:

a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*

b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### **Vitrikerandic Haplocalcids**

FFCQ. Other Haplocalcids which have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:

1. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*

2. Throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:

a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*

b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### **Vitrandic Haplocalcids**

FFCR. Other Haplocalcids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

#### **Xeric Haplocalcids**

FECS. Other Haplocalcids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

#### **Ustic Haplocalcids**

FECT. Other Haplocalcids.

#### **Typic Haplocalcids**

#### **Definition of Typic Haplocalcids**

Typic Haplocalcids are the Haplocalcids which:

1. Do not have a lithic contact within 50 cm of the soil surface;

2. Are dry in all parts of the moisture control section for three-fourths of the time (cumulative) or more when the soil temperature is 5°C or higher at a depth of 50 cm or do not have a moisture regime that borders an ustic or a xeric regime;

3. Have both of the following:

a. No cracks within 125 cm of the soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and no slickensides, or wedge-shaped aggregates, in a layer 15 cm or more thick that has its upper boundary within 125 cm of the soil surface; and

b. A linear extensibility of less than 6.0 cm between the soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower;

4. Are not both irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface nor are they saturated with water, in one or more layers within 100 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years;

5. Do not have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of more than 15 cm and that contain 20 percent or more (by volume) durinodes, nodules, or concretions or are brittle and have at least firm rupture resistance class when moist;

FFAE, Other Petrocalcids which have an arilloic

4. Do not have a calcic horizon overlying the petrocalcic horizon;
5. Have a moisture control section that is dry in all parts for three-fourths of the time (cumulative) or more when the soil temperature is 5°C or higher at a depth of 50 cm or do not have a moisture regime that borders an ustic or a xeric regime;
6. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *either* of the following:
  - a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*
  - b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### **Cambids**

These are the Aridisols with the least degree of soil development. Cambids have a cambic horizon within 100 cm of the soil surface. These soils are permitted to have other diagnostic horizons such as petrocalcic, gypsic, or calcic horizons, but their upper boundary must be below 100 cm from the soil surface. Haplocambids are the most common of the Cambids in the United States.

#### **Definition**

Cambids are the Aridisols which:

1. Have a cambic horizon that has its upper boundary within 100 cm of the soil surface;
2. Have a soil temperature regime warmer than cryic;
3. Do not have a duripan or an argillic, calcic, natric, petrocalcic, gypsic, petrogypsic, or salic horizon that has its upper boundary within 100 cm of the soil surface.

#### **Key to great groups**

FGA. Cambids that are either:

1. Irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; *or*
2. Saturated with water, in one or more layers within 100 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years.

#### **Aquicambids**

FGB. Other Cambids which have a duripan or a petrocalcic or petrogypsic horizon that has its upper boundary within 150 cm of the soil surface.

#### **Petrocambids**

FGC. Other Cambids that have an anthropic epipedon.

#### **Anthracambids**

FGD. Other Cambids.

#### **Haplocambids**

#### **Anthracambids**

These are the Cambids that have an anthropic epipedon. They are soils that have been irrigated for centuries. They are not known to occur in the United States, but the great group is provided for use elsewhere.

#### **Definition of Typic Anthracambids**

All Anthracambids are considered Typic.

#### **Aquicambids**

These are the Cambids that are saturated with water for short periods during most years. These soils often occur adjacent playas and have accumulations of salts in the profile. Aquicambids often have high pH values, which inhibit the formation of redoximorphic features.

#### **Definition**

Aquicambids are the Cambids that are either irrigated and have redoximorphic features in one or more layers within 100 cm of the soil surface or are saturated with water, in one or more layers within 100 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years.

#### **Key to subgroups**

FGAA. Aquicambids which have a horizon at least 25 cm thick within 100 cm of the soil surface, that have an exchangeable sodium percentage of 15 or more (or an SAR of 13 or more) during at least one month of the year in six or more years out of ten.

#### **Sodic Aquicambids**

FGAB. Other Aquicambids that have:

1. One or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) durinodes or are brittle and have at least a firm rupture resistance class when moist; and
2. Are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

#### **Durinodic Xeric Aquicambids**

FGAC. Other Aquicambids that have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) durinodes or are brittle and have at least a firm rupture resistance class when moist.

#### **Durinodic Aquicambids**

FGAD. Other Aquicambids which have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) nodules or concretions.

#### **Petronodic Aquicambids**

FGAE. Other Aquicambids that have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *and*
2. Throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:
  - a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*
  - b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by

**FGAF.** Other Aquicambids which have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:

1. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*
2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### **Vitrandic Aquicambids**

**FGAG.** Other Aquicambids which have an irregular decrease in organic-carbon content from a depth of 25 cm either to a depth of 125 cm, or to a lithic or paralithic contact if shallower.

#### **Fluventic Aquicambids**

**FGAH.** Other Aquicambids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders xeric.

#### **Xeric Aquicambids**

**FGAI.** Other Aquicambids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

#### **Ustic Aquicambids**

**FGAJ.** Other Aquicambids.

#### **Typic Aquicambids**

#### Definition of Typic Aquicambids

Typic Aquicambids are the Aquicambids which:

1. Do not have a horizon at least 25 cm thick within 100 cm of the soil surface, that has an exchangeable sodium percentage of 15 or more (or an SAR of 13 or more) during at least one month of the year in six or more years out of ten;
2. Do not have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of more than 15 cm and that contain 20 percent or more (by volume) durinodes, nodules, or concretions or are brittle and have at least firm rupture resistance class when moist;
3. Have a moisture control section that is dry in all parts for three-fourths of the time (cumulative) or more when the soil temperature is 5°C or higher at a depth of 50 cm or do not have a moisture regime that border an ustic or a xeric regime;
4. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *either* of the following:
  - a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*
  - b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more;
5. Have a regular decrease in organic-carbon content from a depth of 25 cm either to a depth of 125 cm, or to a lithic or paralithic contact if shallower.

#### **Haplocambids**

Haplocambids are the most commonly occurring Cambids in the United States. These soils have minimum horizon expression. Most Haplocambids have a redistribution of carbonates below the cambic horizon. However, the amount of carbonates is insufficient to meet the definition of a calcic horizon or the upper boundary is more than 100 cm below the soil surface. Haplocambids occur on a variety of landscapes, but commonly occur on those younger than late-Pleistocene age.

#### Definition of Haplocambids

Haplocambids are the Cambids which:

1. Are not both irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; nor are they saturated with water, in one or more layers within 100 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years;
2. Do not have a duripan or a petrocalcic or petrogypsic horizon that has its upper boundary within 150 cm of the soil surface;
3. Do not have an anthropic epipedon.

#### Key to subgroups

**FGDA.** Other Haplocambids that have:

1. A lithic contact within 50 cm of the soil surface; and
2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

#### **Lithic Xeric Haplocambids**

**FGDB.** Other Haplocambids that have:

1. A lithic contact within 50 cm of the soil surface; and
2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

#### **Lithic Ustic Haplocambids**

**FGDC.** Other Haplocambids that have a lithic contact within 50 cm of the soil surface.

#### **Lithic Haplocambids**

**FGDD.** Other Haplocambids that have:

1. One or both of the following:
  - a. Cracks within 125 cm of the soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the soil surface; or
  - b. A linear extensibility of 6.0 cm or more between the soil surface and either a depth of 100 cm or to a lithic or paralithic contact, if shallower; and
2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

#### **Xerertic Haplocambids**

**FGDE.** Other Haplocambids that have:

1. One or both of the following:

a. Cracks within 125 cm of the soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the soil surface; or

b. A linear extensibility of 6.0 cm or more between the soil surface and either a depth of 100 cm or to a lithic or paralithic contact, if shallower; and

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

#### Ustertic Haplocambids

FGDF. Other Haplocambids that have at least one of the following:

1. Cracks within 125 cm of the soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, slickensides, or wedge-shaped aggregates, in a layer 15 cm or more thick that has its upper boundary within 125 cm of the soil surface; or

2. A linear extensibility of 6.0 cm or more between the soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower.

#### Vertic Haplocambids

FGDG. Other Haplocambids which have both of the following:

2. Other Haplocambids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the soil moisture regime borders an ustic regime.

#### Sodic Ustic Haplocambids

FGDL. Other Haplocambids that have a horizon at least 25 cm thick within 100 cm of the soil surface, which has an exchangeable sodium percentage of 15 or more (or an SAR of 13 or more) during at least one month of the year in six or more years out of ten.

#### Sodic Haplocambids

FGDM. Other Haplocambids which have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *and*

2. Throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:

a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*

b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and

~~and~~ *and* ~~the 1/2 Re-ment extented by~~

**FGDQ.** Other Haplocambids which have an irregular decrease in organic-carbon content from a depth of 25 cm either to a depth of 125 cm, or to a lithic or paralithic contact if shallower.

#### Fluventic Haplocambids

**FGDR.** Other Haplocambids that are dry in all parts of the moisture control section less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the moisture regime borders a xeric regime.

#### Xeric Haplocambids

**FGDS.** Other Haplocambids that are dry in all parts of the moisture control section less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the moisture regime borders an ustic regime.

#### Ustic Haplocambids

**FGDT.** Other Haplocambids.

#### Typic Haplocambids

#### Definition of Typic Haplocambids

Typic Haplocambids are the Haplocambids which:

1. Do not have a lithic contact within 50 cm of the soil surface;
2. Do not have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of more than 15 cm and that contain 20 percent or more (by volume) durinodes, nodules, or concretions or are brittle and have at least firm rupture resistance class when moist;
3. Are dry in all parts of the moisture control section for three-fourths of the time (cumulative) or more when the soil temperature is 5°C or higher at a depth of 50 cm or the moisture regime does not border an ustic or a xeric regime;
4. Have either:
  - a. No cracks within 125 cm of the soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and no slickensides, nor wedge-shaped aggregates, in a layer 15 cm or more thick that has its upper boundary within 125 cm of the soil surface; or
  - b. A linear extensibility of less than 6.0 cm between the soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower;
5. Do not have a horizon at least 25 cm thick within 100 cm of the soil surface, which has an exchangeable sodium percentage of 15 or more (or an SAR of 13 or more) during at least one month of the year in six or more years out of ten;
6. Have a regular decrease in organic-carbon content from a depth of 25 cm either to a depth of 125 cm, or to a lithic or paralithic contact if shallower;
7. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either of the following:
  - a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; or
  - b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### Petrocambids

These soils have a duripan or a petrocalcic or petrogypsic horizon that has its upper boundary deeper than 100 cm of the soil surface, but within 150 cm of the soil surface. These soils are not extensive because most Aridisols have these diagnostic horizons at shallower depths. However, because of their importance to water movement as well as interpretations, classes for these types of soils are provided.

#### Definition of Petrocambids

Petrocambids are the Cambids which:

1. Have a duripan or petrocalcic or petrogypsic horizon with an upper boundary within 150 cm of the soil surface;
2. Are not both irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; nor are they saturated with water, in one or more layers within 100 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years.

#### Key to subgroups

**FGBA.** Other Petrocambids that have a horizon at least 25 cm thick within 100 cm of the soil surface, which has an exchangeable sodium percentage of 15 or more (or an SAR of 13 or more) during at least one month of the year in 6 or more years out of 10.

#### Sodic Petrocambids

**FGBB.** Other Petrocambids which have both:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; and
2. Throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, one or both of the following:
  - a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; or
  - b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### Vitrixerandic Petrocambids

**FGBC.** Other Petrocambids which have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, one or both of the following:

1. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; or
2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### Vitrandid Petrocambids

**FGBD.** Other Petrocambids that are dry in all parts of the moisture control section less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the moisture regime borders a xeric regime.

#### Xeric Petrocambids

FGBE. Other Petrocambids that are dry in all parts of the moisture control section less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the moisture regime borders an ustic regime.

#### Ustic Petrocambids

FGBF. Other Petrocambids

#### Typic Petrocambids

#### Definition of Typic Petrocambids

Typic Petrocambids are the Petrocambids which:

1. Do not have a horizon of at least 25 cm thick within 100 cm of the soil surface, which has an exchangeable sodium percentage of 15 or more (or an SAR of 13 or more) during at least one month of the year in six or more years out of ten;
2. Are dry in all parts of the moisture control section three-fourths of the time (cumulative) or more when the soil temperature at a depth of 50 cm is 5°C or higher or the moisture regime does not border an ustic or a xeric regime;
3. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either of the following:

- a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are sand, silt, and silt-like

FAF. Other Cryids.

#### Haplocryids

#### Argicryids

These are the Cryids that have an illuvial horizon in which silicate clays have accumulated. In general the Argicryids without natric horizons formed on late-Pleistocene or older sediments or surfaces. Many of these soils receive increments of dust, which may be a source of clay-sized particles. The Argicryids may be on gentle or steep slopes. These soils are not extensive.

#### Definition

Argicryids are the Cryids which:

1. Have an argillic or natric horizon;
2. Do not have a duripan or a gypsic, petrocalcic, petrogypsic, or salic horizon with an upper boundary within 100 cm of the soil surface.

#### Key to subgroups

FADA. Argicryids that have a lithic contact within 50 cm of the soil surface.

#### Lithic Argicryids

FADB. Other Argicryids that have:

1. Cracks within 125 cm of the soil surface that are 5 mm or more wide throughout a thickness of 20 cm

5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### Vitrific Argicryids

FADF. Other Argicryids that are dry in all parts of the moisture control section less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

#### Xeric Argicryids

FADG. Other Argicryids that are dry in all parts of the moisture control section less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

#### Ustic Argicryids

FADH. Other Argicryids.

#### Typic Argicryids

#### Definition of Typic Argicryids

Typic Argicryids are the Argicryids which:

1. Do not have a lithic contact within 50 cm of the soil surface;
2. Have either:
  - a. No cracks within 125 cm of the soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and no slickensides, nor wedge-shaped aggregates, in a layer 15 cm or more thick that has its upper boundary within 125 cm of the soil surface; or
  - b. A linear extensibility of less than 6.0 cm between the soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower;
3. Do not have a natric horizon that has its upper boundary within 100 cm of the soil surface;

2. Do not have a duripan or a gypsic, petrocalcic, petrogypsic, or salic horizon with an upper boundary within 100 cm of the soil surface;

3. Do not have an argillic or a natric horizon.

#### Key to subgroups

FAEA. Calcicryids that have a lithic contact within 50 cm of the soil surface.

#### Lithic Calcicryids

FAEB. Other Calcicryids which have both:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; and

2. Throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:

a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; or

b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### Vitric Argicryids

FAEC. Other Calcicryids which have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:

1. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; or

2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which

3. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either of the following:

a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*

b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### **Gypsicryids**

Gypsicryids are the Cryids that have a gypsic horizon. These soils formed in parent materials rich in gypsum.

Typic Gypsicryids are the Gypsicryids which:

1. Do not have a calcic horizon;

2. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either of the following:

a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*

b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### **Definition**

Gypsicryids are the Cryids which:

These are the Cryids that have a cambic horizon. An ochric epipedon is often present. Other diagnostic horizons may occur below 100 cm. These soils often have an accumulations of calcium carbonate below the cambic horizon.

more within 75 cm of the soil surface, *one or both* of the following:

1. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*
2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### **Vitrandic Haplocryids**

FAFE. Other Haplocryids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

#### **Xeric Haplocryids**

FAFF. Other Haplocryids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

#### **Ustic Haplocryids**

FAFG. Other Haplocryids.

#### **Typic Haplocryids**

#### **Definition of Typic Haplocryids**

Typic Haplocryids are the Haplocryids which:

1. Do not have a lithic contact within 50 cm of the soil surface;
2. Have either:
  - a. No cracks within 125 cm of the soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and no slickensides, nor wedge-shaped aggregates, in a layer 15 cm or more thick that has its upper boundary within 125 cm of the soil surface; *or*
  - b. A linear extensibility of less than 6.0 cm between the soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower;
3. Are dry in all parts of the moisture control section for three-fourths of the time (cumulative) or

Petrocryids are the Cryids which:

1. Have a duripan, petrocalcic, or petrogypsic horizon with an upper boundary within 100 cm of the soil surface;
2. Do not have a salic horizon that has its upper boundary within 100 cm of the soil surface.

#### **Key to subgroups**

FABA. Petrocryids that have:

1. A duripan that has its upper boundary within 100 cm of the soil surface; *and*
2. Are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the soil moisture regime borders a xeric regime.

#### **Duric Xeric Petrocryids**

FABB. Other Petrocryids which have a duripan that has its upper boundary within 100 cm of the soil surface.

#### **Duric Petrocryids**

FABC. Other Petrocryids which have a petrogypsic horizon that has its upper boundary within 100 cm of the soil surface.

#### **Petrogypsic Petrocryids**

FABD. Other Petrocryids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the soil moisture regime borders xeric.

#### **Xeric Petrocryids**

FABE. Other Petrocryids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the soil moisture regime borders ustic.

#### **Ustic Petrocryids**

FABF. Other Petrocryids.

#### **Typic Petrocryids**

#### **Definition of Typic Petrocryids**

Typic Petrocryids are the Petrocryids which:

1. Have a petrocalcic horizon that has its upper boundary within 100 cm of the soil surface;
2. Do not have a duripan or a petrogypsic horizon

FAAB. Other Salicryids.

*Typic Salicryids*

2. A linear extensibility of 6.0 cm or more between  
the soil surface and the top of the duripan.  
*Vertic Argidurids*

b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### Vitrixerandic Argidurids

FABH. Other Argidurids which have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:

1. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*
2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### Vitrandid Argidurids

FCBI. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

#### Xeric Argidurids

FCBI. Other Argidurids which have a moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm from the soil surface is 5°C or higher and a moisture regime that borders on an ustic regime.

#### Ustic Argidurids

~~FCBI. Other Argidurids which have a moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm from the soil surface is 5°C or higher and a moisture regime that borders on an ustic regime.~~

5. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either of the following:

- a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*
- b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more;

6. Have a duripan that is strongly cemented or less cemented in all subhorizons.

#### Haplodurids

These are the Durids which do not have a natric or argillic horizon. These soils formed in materials that have a pyroclastic influence. Most Haplodurids are used for grazing.

#### Definition

Haplodurids are the Durids that do not have an argillic or natric horizon above the duripan.

#### Key to subgroups

FCCA. Haplodurids that:

1. Have a duripan that is strongly cemented or less cemented in all subhorizons; and

2. Are either:

- a. Irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; *or*
- b. Saturated with water, in one or more layers within 100 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years.

#### Aquicambidic Haplodurids

FCCB. Other Haplodurids that are either:

1. Irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; *or*
2. Saturated with water, in one or more layers within 100 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years.

#### Aquic Haplodurids

FCCC. Other Haplodurids that have:

1. A duripan that is strongly cemented or less cemented in all subhorizons; and
2. A mean annual soil temperature lower than 22°C, a difference of 5°C or more between mean summer and mean winter soil temperatures at a depth of 50 cm from the soil surface, and a moisture regime that borders on a xeric regime.

#### Xerochreptic Haplodurids

FCCD. Other Haplodurids that have a duripan that is strongly cemented or less cemented in all subhorizons.

#### Cambidic Haplodurids

FCCE. Other Haplodurids that have:

1. A moisture control section that is dry in all parts for three-fourths of the time (cumulative) or less when the soil temperature at a depth of 50 cm is 5°C or higher and a moisture regime that borders on a xeric regime; *and*

#### Typic Argidurids

#### Definition of Typic Argidurids

Typic Argidurids are the Argidurids which:

1. Do not have either of the following:
  - a. Cracks between the soil surface and the top of the duripan that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, slickensides, or wedge-shaped aggregates, in a layer 15 cm or more thick that has its upper boundary above the duripan; *or*
  - b. A linear extensibility of 6.0 cm or more between the soil surface and the top of the duripan;
2. Are not both irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; nor are they saturated with water, in one or more layers within 100 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years;
3. Have an argillic horizon that has less than 35 percent clay in the fine-earth fraction of some part or;
  - a. A clay increase of less than 15 percent clay (absolute) within a vertical distance of 2.5 cm both within the argillic horizon and at its upper boundary; *or*
  - b. If there is an Ap horizon directly above the argillic horizon, a clay increase of less than 10 percent (absolute) at the upper boundary of the argillic horizon;
4. A moisture control section that is dry in all parts for three-fourths of the time (cumulative) or more when the soil temperature at a depth of 50 cm from the soil surface is 5°C or higher or the moisture regime does not border on a xeric or an ustic regime;

2. Throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:

a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*

b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### Vitrixerandic Haplodurids

FCCF. Other Haplodurids that have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:

1. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*

2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### Vitrandid Haplodurids

FCCG. A mean annual soil temperature lower than 22°C, a difference of 5°C or more between mean summer and mean winter soil temperatures at a depth of 50 cm from the soil surface, and a moisture regime that borders on a xeric regime.

#### Xeric Haplodurids

FCCH. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and a moisture regime that borders on an ustic regime.

#### Ustic Haplodurids

FCCI. Other Haplodurids.

#### Typic Haplodurids

##### Definition of Typic Haplodurids

Typic Haplodurids are the Durids which:

1. Are not both irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface nor are they saturated with water, in one or more layers within 100 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years;

2. Have a moisture control section that is dry in all parts for three-fourths of the time (cumulative) or more when the soil temperature at a depth of 50 cm is 5°C or higher or a moisture regime that does not border on an ustic or a xeric regime;

3. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either of the following:

a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*

b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more;

4. Have a duripan that is indurated or very strongly cemented in at least one subhorizon.

#### Natridurids

These are the Durids that have a natric horizon above the duripan. Commonly, the duripan is within 50 cm of the soil surface. In many places the duripan is also plugged by calcium carbonate. The soils are commonly on gently sloping landscapes and formed in materials derived from pyroclastics. They are not extensive and most are used for grazing.

##### Definition

Natridurids are the Durids that have a natric horizon above the duripan.

##### Key to subgroups

FCAA. Natridurids which have, above the duripan, one or both of the following:

1. Cracks between the soil surface and the top of the duripan that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, slickensides, or wedge-shaped aggregates, in a layer 15 cm or more thick that has its upper boundary above the duripan; *or*

2. A linear extensibility of 6.0 cm or more between the soil surface and the top of the duripan.

#### Vertic Natridurids

FCAB. Other Natridurids which have both:

1. A duripan that is strongly cemented or less cemented in all subhorizons; and

2. Either:

a. Irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; *or*

b. Saturated with water, in one or more layers within 100 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years.

#### Aquic Natrargidic Natridurids

FCAC. Other Natridurids that are either:

1. Irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; *or*

2. Saturated with water, in one or more layers within 100 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years.

#### Aquic Natridurids

FCAD. Other Natridurids that have the following combination of characteristics:

1. Have a duripan that is strongly cemented or less cemented in all subhorizons; and

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

#### Natraxeralfic Natridurids

FCAE. Other Natridurids that have a duripan that is strongly cemented or less cemented in all subhorizons.

#### Natrargidic Natridurids

FCAF. Other Natridurids that have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *and*

2. Throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:

a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*

b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### Vitrixerandic Natridurids

FCAG. Other Natridurids which have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:

1. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*

2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### Vitrandid Natridurids

FCAH. Other Natridurids that have a moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

#### Xeric Natridurids

FCAI. Other Natridurids.

#### Typic Natridurids

#### Definition of Typic Natridurids

Typic Natridurids are the Durids which:

1. Do not have either of the following:

a. Cracks between the soil surface and the top of the duripan that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, slickensides, or wedge-shaped aggregates, in a layer 15 cm or more thick that has its upper boundary above the duripan; *nor*

b. A linear extensibility of 6.0 cm or more between the soil surface and the top of the duripan;

2. Are not both irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; *nor* are they saturated with water, in one or more layers within 100 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years;

3. Have a moisture control section that is dry in all parts for than three-fourths of the time (cumulative) or more when the soil temperature is 5°C or higher at a depth of 50 cm or the moisture regime does not border on an ustic or a xeric regime;

4. Have a duripan that is either indurated or very strongly cemented in at least one subhorizon;

5. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either of the following:

a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*

b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### Gypsis

Gypsis are the Aridisols that have a gypsic or petrogypsic horizon within 100 cm of the soil surface. Accumulation of gypsum takes place initially as crystal aggregates in the voids of the soil. These aggregates grow by accretion, displacing the enclosing soil material. When the gypsic horizon is present as a cemented impermeable layer, it is recognized as the petrogypsic horizon. Each of these forms of gypsum accumulation infers processes in the soils and each presents a constraint to soil use.

The presence of one or more of these horizons, with or without other diagnostic horizons, define the great groups in the Gypsis. The Petrogypsis have a petrogypsic horizon within 100 cm of the soil surface. When they are close to the surface, crusting forms pseudo-hexagonal patterns on the soil surface. Petrogypsis occupy old surfaces. In Syria and Iraq, they are present on the highest terraces of the Tigris and Euphrates Rivers.

The Haplogypsis are present on many segments of the landscape. Some of them have a calcic or related horizons which overlie the gypsic horizon.

#### Definition

Gypsis are the Aridisols which:

1. Have a gypsic or petrogypsic horizon that has an upper boundary within 100 cm of the soil surface;
2. Do not have a petrocalcic horizon overlying the gypsic or petrogypsic horizon;
3. Have a soil temperature regime warmer than cryic;
4. Do not have a duripan or salic horizon that has an upper boundary within 100 cm of the soil surface.

#### Key to great groups

FDA. Gypsis that have a petrogypsic or petrocalcic horizon that has its upper boundary within 100 cm of the soil surface.

#### Petrogypsis

FDB. Other Gypsis that have a natric horizon that has its upper boundary within 100 cm of the soil surface.

#### Natrigypsis

FDC. Other Gypsis that have an argillic horizon that has its upper boundary within 100 cm of the soil surface.

#### Argigypsis

FDD. Other Gypsis that have a calcic horizon that has its upper boundary within 100 cm of the soil surface.

#### Calcigypsis

FDE. Other Gypsis.

#### Haplogypsis

#### Argigypsis

Argigypsis are the Gypsis that have an argillic horizon. These soils are known to occur in the Four Corners area of the western United States. They are used primarily for grazing.

#### Definition

Argigypsis are the Gypsis which:

1. Have an argillic horizon that has its upper boundary within 100 cm of the soil surface;
2. Do not have a natric or petrogypsic horizon with an upper boundary within 100 cm of the soil surface.

**Key to subgroups**

FDCA. Argigypsid which have a lithic contact within 50 cm of the soil surface.

**Lithic Argigypsid**

FDCB. Other Argigypsid which have:

1. Cracks within 125 cm of the soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, slickensides, or wedge-shaped aggregates, in a layer 15 cm or more thick that has its upper boundary within 125 cm of the soil surface; or
2. A linear extensibility of 6.0 cm or more between the soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower.

**Vertic Argigypsid**

FDCC. Other Argigypsid which have a calcic horizon overlying the gypsic horizon.

**Calcic Argigypsid**

FDCD. Other Argigypsid which have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) durinodes, nodules, or concretions.

**Petronodic Argigypsid**

FDCE. Other Argigypsid which have both:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; and
2. Throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, one or both of the following:
  - a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; or
  - b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

**Vitrixerandic Argigypsid**

FDCF. Other Argigypsid which have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, one or both of the following:

1. More than 35 percent (by volume) fragments

FDCH. Other Argigypsid which have a moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and a moisture regime that borders an ustic regime.

**Ustic Argigypsid**

FDCI. Other Argigypsid.

**Typic Argigypsid****Definition of Typic Argigypsid**

Typic Argigypsid are the Argigypsid which:

1. Do not have a lithic contact within 50 cm of the soil surface;
2. Have either:
  - a. No cracks within 125 cm of the soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and no slickensides, nor wedge-shaped aggregates, in a layer 15 cm or more thick that has its upper boundary within 125 cm of the soil surface; or
  - b. A linear extensibility of less than 6.0 cm between the soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower;
3. Do not have a calcic horizon overlying the gypsic horizon;
4. Have a moisture control section that is dry in all parts for three-fourths of the time (cumulative) or more when the soil temperature at a depth of 50 cm is 5°C or higher or do not have a moisture regime that borders an ustic or a xeric moisture regime;
5. Do not have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of more than 15 cm and that contain 20 percent or more (by volume) durinodes, nodules, or concretions or are brittle and have at least firm rupture resistance class when moist;
6. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either of the following:
  - a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; or
  - b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

**Calcigypsid**

Calcigypsid are the Gypsid that have a calcic horizon.

Key to subgroups

FDDA. Calcigypsid that have a lithic contact within 100 cm of the soil surface.

**Lithic Calcigypsid**

FDDB. Other Calcigypsid which have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) durinodes, nodules, or concretions.

**Petronodic Calcigypsid**

FDDC. Other Calcigypsid which have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *and*

2. Throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:

a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*

b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

**Vitrikerandic Calcigypsid**

FDDD. Other Calcigypsid which have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:

1. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*

2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

**Vitrandid Calcigypsid**

FDDE. Other Calcigypsid that have a moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and have a moisture regime that borders on a xeric regime.

**Xeric Calcigypsid**

FDDF. Other Calcigypsid that have a moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and have a moisture regime that borders on an ustic regime.

**Ustic Calcigypsid**

FDDG. Other Calcigypsid.

**Typic Calcigypsid**Definition of Typic Calcigypsid

Typic Calcigypsid are the Calcigypsid which:

1. Have a moisture control section that is dry in all parts for three-fourths of the time (cumulative) or more when the soil temperature at a depth of 50 cm is 5°C or higher or the moisture regime does not border an ustic or xeric regime;

2. Do not have a lithic contact within 100 cm of the soil surface;

3. Do not have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of more than 15 cm and that contain 20 percent or more (by volume) durinodes, nodules, or concretions or are brittle and have at least firm rupture resistance class when moist;

4. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either of the following:

a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*

b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

**Haplogypsid**

Haplogypsid are the Gypsid that have no petrogypsic, natric, argillic, or calcic horizon that has an upper boundary within 100 cm of the soil surface. Some have a cambic horizon overlying the gypsic horizon. These soils are commonly very pale in color. They are not extensive in the United States, but the largest concentrations are in New Mexico and Texas. In other parts of the world Haplogypsid are more common.

Definition of Haplogypsid

These are the Gypsid which:

1. Do not have a petrogypsic or calcic horizon that has an upper boundary within 100 cm of the soil surface;

2. Do not have an argillic or natric horizon that has an upper boundary within 100 cm of the soil surface.

Key to subgroups

FDEA. Haplogypsid that have a lithic contact within 50 cm of the soil surface.

**Lithic Haplogypsid**

FDEB. Other Haplogypsid which have a gypsic horizon that has its upper boundary within 18 cm of the soil surface.

**Leptic Haplogypsid**

FDEC. Other Haplogypsid which have in one or more horizons, within 100 cm of the soil surface, an exchangeable sodium percentage of 15 or more (or a sodium adsorption ratio of 13 or more) for 6 or more months per year in 6 or more out of 10 years.

**Sodic Haplogypsid**

FDED. Other Haplogypsid which have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) durinodes, nodules, or concretions.

**Petronodic Haplogypsid**

FDEE. Other Haplogypsid which have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *and*

2. Throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:

a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66

percent are cinders, pumice, and pumice-like fragments; *or*

b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### Vitrixerandic Haplogypsis

FDEF. Other Haplogypsis which have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:

1. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*
2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### Vitrantic Haplogypsis

FDEG. Other Haplogypsis that have a moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and have a moisture regime that borders on a xeric regime.

#### Xeric Haplogypsis

FDEH. Other Haplogypsis that have a moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and have a moisture regime that borders on an ustic regime.

#### Ustic Haplogypsis

FCEI. Other Haplogypsis.

#### Typic Haplogypsis

#### Definition of Typic Haplogypsis

Typic Haplogypsis are the Haplogypsis which:

1. Do not have a lithic contact within 50 cm of the soil surface;
2. Do not have a gypsic horizon that has its upper boundary within 18 cm of the soil surface;
3. Do not have in one or more horizons, within 100 cm of the soil surface, an exchangeable sodium percentage of 15 or more (or a sodium adsorption ratio of 13 or more) for 6 or more months per year in 6 or more out of 10 years;
4. Have a moisture control section that is dry in all its parts for three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher or the moisture regime does not border an ustic or a xeric regime;
5. Do not have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of more than 15 cm and that contain 20 percent or more (by volume) durinodes, nodules, or concretions or are brittle and have at least firm rupture resistance class when moist;
6. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either of the following:
  - a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*
  - b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of

which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### Natrigypsis

Natrigypsis are the Gypsis that have a natric horizon and no petrogypsic or petrocalcic horizon within 100 cm of the soil surface. The gypsic horizon is commonly below the natric horizon. These soils formed in parent materials high in gypsum and sodium such as sedimentary materials that were deposited in a marine environment. These soils are rare, but are known to occur in the Four Corners area of the western United States. The Natrigypsis are used primarily for grazing.

#### Key to subgroups

FDDB. Natrigypsis that have a lithic contact within 50 cm of the soil surface.

#### Lithic Natrigypsis

FDBB. Other Natrigypsis that have:

1. Cracks within 125 cm of the soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, slickensides, or wedge-shaped aggregates, in a layer 15 cm or more thick that has its upper boundary within 125 cm of the soil surface; *or*
2. A linear extensibility of 6.0 cm or more between the soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower.

#### Vertic Natrigypsis

FDBC. Other Natrigypsis which have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) durinodes, nodules, or concretions.

#### Petronodic Natrigypsis

FDBD. Other Natrigypsis which have both:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *and*
2. Throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:

- a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*
- b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### Vitrixerandic Natrigypsis

FDBE. Other Natrigypsis which have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:

1. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*
2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### Vitrantic Natrigypsis

**FDBF.** Other Natrigypsid that have a moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and have a moisture regime that borders a xeric regime.

#### **Xeric Natrigypsid**

**FDBG.** Other Natrigypsid that have a moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and have a moisture regime that borders an ustic regime.

#### **Ustic Natrigypsid**

**FDBH.** Other Natrigypsid.

#### **Typic Natrigypsid**

#### Definition of Typic Natrigypsid

Typic Natrigypsid are the Natrigypsid which:

1. Do not have a lithic contact within 50 cm of the soil surface;
2. Have either:
  - a. No cracks within 125 cm of the soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and no slickensides, nor wedge-shaped aggregates, in a layer 15 cm or more thick that has its upper boundary within 125 cm of the soil surface; or
  - b. A linear extensibility of less than 6.0 cm between the soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower;
3. Have a moisture control section that is dry in all parts for three-fourths of the time (cumulative) or more when the soil temperature at a depth of 50 cm is 5°C or higher or the moisture regime does not border an ustic or xeric regime;
4. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either of the following:
  - a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; or
  - b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more;
5. Do not have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of more than 15 cm and that contain 20 percent or more (by volume) durinodes, nodules, or concretions or are brittle and have at least firm rupture resistance class when moist.

#### **Petrogypsid**

Petrogypsid are the Gypsid that have a petrogypsic or petrocalcic horizon that has its upper boundary within 100 cm of the soil surface. These soils occur in very arid areas of the world where the parent material is high in gypsum. These soils are not extensive in the United States, but are in other countries.

**FDAA.** Other Petrogypsid which have a petrocalcic horizon that has its upper boundary within 100 cm of the soil surface.

#### **Petrocalcic Petrogypsid**

**FDAB.** Other Petrogypsid which have a calcic horizon overlying the petrogypsic horizon.

#### **Calcic Petrogypsid**

**FDAC.** Other Petrogypsid which have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; and
2. Throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:
  - a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; or
  - b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### **Vitrikerandic Petrogypsid**

**FDAD.** Other Petrogypsid which have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:

1. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; or
2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### **Vitrandic Petrogypsid**

**FDAE.** Other Petrogypsid that have a moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and have a moisture regime that borders a xeric regime.

#### **Xeric Petrogypsid**

**FDAF.** Other Petrogypsid that have a moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and have a moisture regime that borders an ustic regime.

#### **Ustic Petrogypsid**

**FDAG.** Other Petrogypsid.

#### **Typic Petrogypsid**

#### Definition of Typic Petrogypsid

Typic Petrogypsid are the Petrogypsid which:

1. Do not have a petrocalcic horizon within 100 cm of the soil surface;
2. Do not have a calcic horizon overlying the

4. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either of the following:

- a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments.

Although these soils may have water held at a tension greater than 1500 kPa, the dissolved salt content makes these soils physiologically dry.

Definition

Aquisalids are the Salids that are saturated with water in one or more layers within 100 cm of the mineral soil

"a. A salic horizon, if the upper boundary is within 100 cm of the soil surface, unless it is a buried horizon."

And in item 3c. after horizon, add the following:

"if the upper boundary is within 100 cm of the soil surface."

Page 190, left column, lines 30 and 41. Change "Durorthids" to "Durids". And lines 22, 33, 47, and 48. Change "Durorthidic" to "Duridic".

Page 194, left column, line 7. Change "weak" to "partial". left column, line 9. Change "Durorthids" to "Durids". left column, line 29. Change "Durorthidic" to "Durinodic". left column, line 32 change "weakly cemented" to "partially cemented".

Page 197, right column, lines 27. Change "Durorthidic" to "Haploduridic". right column, line 31, change "have weak cementation" to "are partially cemented". right column, line 36, change "Durorthidic" to "Durinodic". right column, line 47, change "Durorthidic" to "Durinodic". right column, line 48 change "weakly cemented" to "partially cemented".

Page 201, right column, line 44. Change "Durorthidic" to "Duridic".

Page 205, left column, line 41. Change "Durorthidic" to "Haploduridic". left column, line 46 change "weakly" to "partially".

Page 209, left column, line 6. Change "Durorthidic" to "Durinodic".

Page 227, right column, Definition of Inceptisol. Replace item 1d. with the following:

"d. Do not have a salic horizon and saturation with water in one or more layers within 100 cm of the soil surface for 1 month or more per year in 6 out of 10 years;"

Page 228, Limits between Inceptisols and the other orders. Change item 3. (refer to 615-79) after the words salic horizon to the following: "and saturation with water in one or more layers within 100 cm of the soil surface for 1 month or more per year in 6 out of 10 years."

NSTH 615.62, p. 615-349, HDFS. (see 615.89, p. 615-499). Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

NSTH 615.62, p. 615-350, HDFZ. (see 615.89, p. 615-499). Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

Page 304, right column, line 17. Change "Salorthidic" to "Salidic".

Page 305, left column, line 38. Change "Salorthidic" to "Salidic".

Page 308, right column, line 58. Change "Calciorthids" to "Calcids".

Page 309, left column, line 38. Change "Calciorthidic" to "Calcidic".

Page 312, right column, line 10. Change "Aridic Calcic" to "Calciargidic". right column, line 53 change "Durargidic" to "Argiduridic".

Page 318, left column, line 19. Change "Calciorthidic" to "Calcidic".

Page 321, right column, line 3. Change "Aridic Petrocalcic" to "Petrocalcidic".

NSTH 615.26, p. 615-30, lines 9 and 18. Change "Orthidic" to "Haploduridic" and in the Definition of Typic Durustolls, "Argids" should be "Durids".

NSTH 615.62, p. 615-209, right column, item IAGG. (see p. 615-516). Change "Durorthidic" to "Durinodic".

NSTH 615.62, p. 615-232, right column, item ICCG. (see p. 615-519). Change "Salorthidic" to "Salidic".

NSTH 615.62, p. 615-234, left column, item ICFL. (see p. 615-445). Change "Calciorthidic" to "Calcidic".

NSTH 615.62, p. 615-268, right column, items KDDG. and KDDH. (see p. 615-465). Change "Durorthidic" to "Duridic".

NSTH 615.62, p. 615-271, left column, item KDBG. (see p. 615-467). Change "Durorthidic" to "Durinodic".

Page 257, left column, line 25. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

Page 285, left column, line 49. Change "Calciorthids" to "Calcids".

Page 298, right column, line 42. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

Page 301, left column, line 23. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

Page 302, right column, line 58. Delete "soft powdery or disseminated lime" and replace with "identifiable secondary carbonates".

Page 304, left column, line 51. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

NSTH 615.62, p. 615-344, HDEI. (see 615.90, p. 615-544). Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

NSTH 615.62, p. 615-345, HDEQ. (see 615.90, p. 615-544). Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

NSTH 615.62, p. 615-345, HDES. (see 615.90, p. 615-544) Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

NSTH 615.62, p. 615-349, HDFI. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

NSTH 615.62, p. 615-273, right column, items KEBH., KEBK., and KEBL. (see p. 615-468). Change "Durorthidic" to "Haploduridic".

NSTH 615.62, p. 615-276, right column, item KEEF. (see p. 615-469). Change "Durorthidic" to "Durinodic".

NSTH 615.62, p. 615-276, right column, items KECE. and KECH. (see page 615-469). Change "Durorthidic" to "Duridic".

NSTH 615.62, p. 615-278, right column, items KCBB. and KCBC. Change "Durorthidic" to "Haploduridic".

NSTH 615.62, p. 615-280, right column, items KCFB. and KCFE. (see p. 615-473). Change "Durorthidic" to "Durinodic".

NSTH 615.62, p. 615-317, right column, item HEDB. Change "Abruptic Aridic" to "Paleargidic".

NSTH 615.62, p. 615-322, left column, item HEGA. Change "Salorthidic" to "Salidic".

NSTH 615.62, p. 615-334, left column, item HFDA. Change "Salorthidic" to "Salidic".

NSTH 615.62, p. 615-336, left column, item HFAB. Change "Orthidic" to "Haploduridic", and HFAC. Change "Aridic" to "Argiduridic".

NSTH 615.62, p. 615-336, right column, item HFGA. Change "Salorthidic" to "Salidic".

NSTH 615.62, p. 615-342, left column, item HFCCG. Change "Calciorthidic" to "Calciargidic".

NSTH 615.62, p. 615-351, right column, item HDCE.  
Change "Aridic Petrocalcic" to "Petrocalcic".

NSTH 615.62, p. 615-349, right column, item HDFS. (see p. 615-499). Change "Calciorthic" to "Calcic".

NSTH 615.89, p. 615-479, left column, item JAAA.  
Change "Salorthic" to "Salidic".

NSTH 615.101, p. 615-598, right column, item JDEL.  
Change "Calciorthic" to "Haplocalcic".

#### 615.116 Subgroups of Durixerolls

The subgroups of Durixerolls are revised based in part on the recommendations made in the final report of the International Committee on Aridisols.

Page 315 and NSTH 615.62 p. 615-347 Delete all subgroups of Durixerolls following HDAC (changed to HDAD NSTH 615.90 P. 615-345) Aquic Durixerolls

2. A duripan that is neither very strongly cemented nor indurated in any subhorizon.

#### Haplic Paleixerollic Durixerolls

HDAL. Other Durixerolls which have an argillic horizon that has a clay increase with depth *either* of 20 percent or more (absolute) within 7.5 cm, *or* of 15 percent or more (absolute) within 2.5 cm.

#### Palexerollic Durixerolls

HDAM. Other Durixerolls which:

1. Have a duripan that is neither very strongly cemented nor indurated in any subhorizon; *and*
2. Do not have an argillic horizon above the duripan.

#### Haplic Haploxerollic Durixerolls

HDAN. Other Durixerolls which do not have an argillic horizon above the duripan.

"HDAE. Other Durixerolls which have:

1. An aridic moisture regime; *and*
2. An argillic horizon that has a clay increase with depth *either* of 20 percent or more (absolute) within 7.5 cm, *or* of 15 percent or more (absolute) within 2.5 cm; *and*
3. A duripan that is neither very strongly cemented nor indurated in any subhorizon.

#### Paleargidic Durixerolls

HDAF. Other Durixerolls which have *both*:

1. An aridic moisture regime; *and*
2. An argillic horizon that has a clay increase with depth *either* of 20 percent or more (absolute) within 7.5 cm, *or* of 15 percent or more (absolute) within 2.5 cm.

#### Abruptic Argiduridic Durixerolls

HDAG. Other Durixerolls which:

1. Have an aridic moisture regime; *and*
2. Do not have an argillic horizon above the duripan; *and*
3. Have a duripan that is neither very strongly cemented nor indurated in any subhorizon.

#### Cambidic Durixerolls

HDAH. Other Durixerolls which:

1. Have an aridic moisture regime; *and*

HDAO. Other Durixerolls which have a duripan that is neither very strongly cemented nor indurated in any subhorizon.

#### Haplic Durixerolls

HDAP. Other Durixerolls.

#### Typic Durixerolls"

NSTH 615.62, p. 615-347, Definition of Typic Durixerolls, replace statements 1., 2., and 6. with the following:

"1. Do not have an argillic horizon that has a clay increase with depth *either* of 20 percent or more (absolute) within 7.5 cm, *or* of 15 percent or more (absolute) within 2.5 cm;"

"2. Have a duripan that is either very strongly cemented or indurated in some subhorizon;"

"6. Do not have, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, *one or both* of the following:

a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*

b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more."

The criteria for Vitrandic subgroups and the "vitrandic"

NSTH 615.89, p. 615-438, IEED. (see 5th edition of the

Aquandic criteria with the following criteria as indicated below:

NSTH 615.89, p. 615-438, IEED. (see 5th edition of the

"(--) Other (---) that have, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, *one or more* of the following:

1. A fine-earth fraction with both a bulk density of 1.0 g/cm<sup>3</sup> or less, measured at 33 kPa water retention, and aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling more than 1.0; *or*

2. More than 35 percent (by volume) fragments

NSTH 615.62, p. 615-222, IEKF. (see NSTH 615.89, p. 615-439). Item 2.:

NSTH 615.62, p. 615-236, IDCB. Item 2.:

NSTH 615.89, p. 615-446, IDGE. Item 2c.:

NSTH 615.62, p. 615-237, IDGG. (see 615.89, p. 615-446). Item 2.:

NSTH 615.89, p. 615-447, IDFR. Item 2c.:

NSTH 615.62, p. 615-311, JEDD. Item 2.:

NSTH 615.62, p. 615-313, JECC. Item 2.:

NSTH 615.62, p. 615-318, HEDI. (see 615.90, p. 615-534). Item 2.:

NSTH 615.62, p. 615-321, HERK. Item 2.:

NSTH 615.62, p. 615-224, Definition of Typic Hapludalfs. Item 2c.:

NSTH 615.62, p. 615-237, Definition of Typic Fragixeralfs. Item 2c.:

NSTH 615.62, p. 615-239, Definition of Typic

NSTH 615.62, p. 615-306, Definition of Typic  
Dystropepts (see 615.89, p. 615-484). Item 3c.:

And renumber items KCAE. through KCAG. as KCAF.  
through KCAH.

NSTH 615.62, p. 615-306, Definition of Typic Dystropepts

Items 306 and NSTH 615.62, p. 615-377, Definition of

5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

#### Vitrandic Calcixerolls"

And renumber items HDDF. through HDDH. to HDDG. through HDDI.

NSTH 615.62 p. 615-346, description of Typic Calcixerolls following item 7, renumbered in NSTH 615.89 p. 615-499 add item 8. as follows:

"8. Do not have, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, *one or both* of the following:

- More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*
- A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more."

#### 615.120 Strongly Contrasting Particle-size Classes

NSTH 615.60, p. 615-207 (revised 615.112 p. 615-605) (*Soil Taxonomy* p. 386). Following item 48. Medial over sandy or sandy-skeletal. (added NSTH 615.112 p. 615-605) add new item 49. to read as follows:.

"49. Medial-skeletal over fragmental or cindery if the volume of the fine earth fraction is 35 percent or more (absolute) greater in the medial-skeletal part than the fragmental or cindery part."

And renumber items 49. through 55. as 50. through 56.

#### 615.121 Humaqueptic and Mollic subgroups of Aquepts and Aquepts

This amendment changes the criteria for Humaqueptic and Mollic subgroups of Aquepts and Aquepts to allow for mixing when determining color of the surface layer and clarifies the base status requirement. Also Humic and Mollic subgroups are added in Epiaquepts.

NSTH 615.89 p. 615-462 item KAGD. and KAGE. Replace with the following:

"KAGD. Other Endoaquepts which have *both*:

- An Ap horizon that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors; *and*
- A base saturation (by NH<sub>4</sub>OAc) of less than 50 percent, in some part, within a depth of 100 cm from the mineral soil surface.

#### Humaqueptic Endoaquepts

KAGE. Other Endoaquepts which have *either* an Ap horizon that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors."

#### Mollic Endoaquepts"

NSTH 615.89 p. 615-462 Definition of Typic Endoaquepts, replace item 2. with the following:

"2. Have an Ap horizon that has a color value, moist, of 4 or more or a color value, dry, of 6 or more (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors."

NSTH 615.89 p. 615-463 Replace items KAFB. and K AFC. with the following:

"KAFB. Other Epiaquepts which have *both*:

- An Ap horizon that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors *and*"
- A base saturation (by NH<sub>4</sub>OAc) of less than 50 percent, in some part, within a depth of 100 cm from the mineral soil surface.

#### Humaqueptic Epiaquepts

K AFC. Other Epiaquepts which have *either* an Ap horizon that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors.

#### Mollic Epiaquepts"

NSTH 615.89 p. 615-463 Definition of Typic Epiaquepts, replace item 3. with the following:

"2. An Ap horizon that has a color value, moist, of 4 or more or a color value, dry, of 6 or more (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors."

Page 183 and NSTH 615.62 p. 615-264. Replace items KAEI. and KAEJ. with the following:

"KAEI. Other Fluvaquepts which have *both*:

- An Ap horizon that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors *and*"
- A base saturation (by NH<sub>4</sub>OAc) of less than 50 percent, in some part, within a depth of 100 cm from the mineral soil surface.

#### Humaqueptic Fluvaquepts

KAEJ. Other Fluvaquepts which have *either* an Ap horizon that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors.

#### Mollic Fluvaquepts"

NSTH 615.62 p. 615-265 Definition of Typic Fluvaquepts, replace item 4. with the following:

"4. Have an Ap horizon that has a color value, moist, of 4 or more or a color value, dry, of 6 or more (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors;"

Page 186 and NSTH 615.62 p. 615-266 and NSTH 615.89, p. 615-464. Replace items KADC. and KADD. with the following:

"KADC. Other Psammaquepts which have *both*:

- An Ap horizon that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors *and*
- A base saturation (by NH<sub>4</sub>OAc) of less than 50 percent, in some part, within a depth of 100 cm from the mineral soil surface.

#### Humaqueptic Psammaquepts

KADD. Other Psammaquepts which have *either* an Ap horizon that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors.

#### Mollic Psammaquepts"

NSTH 615.62 p. 615-266 Definition of Typic Psammaquepts, replace item 2. with the following:

"2. Have an Ap horizon that has a color value, moist, of 4 or more or a color value, dry, of 6 or more (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors;"

NSTH 615.89 p. 615-476 replace items JAJF. and JAJG. with the following:

"JAJF. Other Endoaquepts which have *both*:

1. An Ap horizon that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors *and*

2. A base saturation (by  $\text{NH}_4\text{OAc}$ ) of less than 50 percent in some part, within 100 cm of the mineral soil surface.

**Humic Endoaquepts**

JAJG. Other Endoaquepts which have either an Ap horizon that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors.

**Mollic Endoaquepts"**

NSTH 615.89 p. 615-477 Definition of Typic Endoaquepts, replace item 2. with the following:

"2. An Ap horizon that has a color value, moist, of 4 or more or a color value, dry, of 6 or more (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors;"

NSTH 615.89 p. 615-478 add the following items, JAIC. and JAID.:

"JAIC. Other Epiaquepts which have *both*:

1. An Ap horizon that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors *and*

2. A base saturation (by  $\text{NH}_4\text{OAc}$ ) of less than 50 percent in some part, within 100 cm of the mineral soil surface.

**Humic Epiaquepts**

JAID. Other Epiaquepts which have an Ap horizon that has a color value, moist, of 3 or less *and* a color value, dry, of 5 or less (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors.

**Mollic Epiaquepts"**

And renumber item JAIC. to JAIE.

NSTH 615.89 p. 615-478 Definition of Typic Epiaquepts, add following item 2. item 3. as follows:

"3. An Ap horizon that has a color value, moist, of 4 or more or a color value, dry, of 6 or more (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors."

**615.122 Subgroups of Psammments**

The criteria for argic subgroups are clarified and made consistent between the great groups. An aridic subgroup is added to Ustipsammments.

the requirements for an argillic horizon except for thickness or clay content or both.

**Argic Cryopsammments"**

Page 204 and NSTH 615.62 p. 615-277 Definition of Typic Cryopsammments (Soil Taxonomy p. 202), replace item 1. with the following:

"1. Do not have lamellae within 200 cm of the mineral soil surface that meet all the requirements for an argillic horizon except for thickness or clay content or both.

NSTH 615.62 p. 615-278 (Revised in NSTH 615.72 p. 615-397) Replace item KCCH. and KCCI. with the following:

"KCCH. Other Quartzipsammments which have:

1. Lamellae within 200 cm of the mineral soil surface that meet all the requirements for an argillic horizon except for thickness or clay content or both; *and*

2. An ustic moisture regime.

**Argic Ustic Quartzipsammments**

KCCI. Other Quartzipsammments which have lamellae within 200 cm of the mineral soil surface that meet all the requirements for an argillic horizon except for thickness or clay content or both.

**Argic Quartzipsammments"**

Page 206 and NSTH 615.72 p. 615-397 Definition of Typic Quartzipsammments, column 2 (Soil Taxonomy p. 204) replace item 7. (renumbered in NSTH 615.89 p. 615-471 to 8.) with the following:

"8. Do not have lamellae within 200 cm of the mineral soil surface that meet all the requirements for an argillic horizon except for thickness or clay content or both.

NSTH 615.62 p. 615-279 (Revised in NSTH 615.72 p. 615-398) Replace item KCGE. with the following:

"KCGE. Other Udipsammments which have lamellae within 200 cm of the mineral soil surface that meet all the requirements for an argillic horizon except for thickness or clay content or both.

**Argic Udipsammments"**

NSTH 615.62 p. 615-279 Definition of Typic Udipsammments, column 2 (Soil Taxonomy p. 206) replace item 1. with the following:

"1. Do not have lamellae within 200 cm of the mineral soil surface that meet all the requirements for an argillic horizon except for thickness or clay content or both.

Page 207 and NSTH 615.62 p. 615-280 (Revised in NSTH 615.72 p. 615-398) After KCEC. add new KCED., replace item KCED. with KCEE. and change the numbering of item KCEE. to KCEF.:

"KCED. Other Ustipsammments which, if neither irrigated nor allowed to store moisture, have *one* of the following:

1. A frigid soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, is dry in all parts for four tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

2. A mesic or thermic soil temperature regime, *and* a moisture control section which, in 6 or more out

3. A hyperthermic, an isomesic, or a warmer iso soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, is moist in some or all parts for less than 180 cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C.

**Aridic Ustipsamments"**

"KCEE. Other Ustipsamments which have lamellae within 200 cm of the mineral soil surface that meet all the requirements for an argillic horizon except for thickness or clay content or both.

**Argic Ustipsamments"**

NSTH 615.62 n. 615-280 (revised 615.72 n. 615-398)

"1. Have one or more layers, with a combined thickness of 25 cm or more, consisting of hemic materials below the surface tier; *and*"

Change item ABCE.1. to:

"1. Have one or more layers, with a combined thickness of 12.5 cm or more, consisting of sapric materials below the surface tier; *and*"

Change item ABCJ. to:

"ABCJ. Other Borofibrists that have one or more layers, with a combined thickness of 25 cm or more, consisting of hemic materials below the surface tier.

Change item ABAI. to:

"ABAI. Other Sphagnofibrists that have one or more layers, with a combined thickness of 12.5 cm or more, consisting of sapric materials below the surface tier.  
**Sapric Sphagnofibrists**"

Page 216 and NSTH 615.62 p. 615-283, definition of Typic Sphagnofibrists change item 2. to read:

"2. Have:

- a. Less than 25 cm consisting of hemic materials below the surface tier; *and*"
- b. Less than 12.5 cm consisting of sapric materials below the surface tier;"

Page 217 and NSTH 615.62 p. 615-283, change item ABDC.1. to:

"1. One or more layers, with a combined thickness of 25 cm or more, consisting of hemic materials below the surface tier; *and*"

Change item ABDD.1. to:

"1. One or more layers, with a combined thickness of 12.5 cm or more, consisting of sapric materials below the surface tier; *and*"

Change item ABDH. to:

"~~ABDH~~. Other Tropofibrists that have one or more layers, with a combined thickness of 25 cm or more, consisting of hemic materials below the surface tier.  
**Hemic Tropofibrists**"

Change item ABDI. to:

"ABDI. Other Tropofibrists that have one or more layers, with a combined thickness of 12.5 cm or more, consisting of sapric materials below the surface tier.  
**Sapric Tropofibrists**"

Page 217 and NSTH 615.62 p. 615-283, definition of Typic Tropofibrists change item 1. to read:

"1. Have:

- a. Less than 25 cm consisting of hemic materials below the surface tier; *and*"
- b. Less than 12.5 cm consisting of sapric materials below the surface tier;"

Page 220 and NSTH 615.62 p. 615-285 change item ACEC.1. to:

"1. One or more layers, with a combined thickness of 25 cm or more, consisting of fibric materials below the surface tier; *and*"

Change item ACED.1. to:

"1. One or more layers, with a combined thickness of 25 cm or more, consisting of sapric materials below the surface tier; *and*"

Change item ACEH. to:

"ACEH. Other Borohemists that have one or more layers, with a combined thickness of 25 cm or more, consisting of fibric materials below the surface tier.  
**Fibric Borohemists**"

Change item ACEI. to:

"ACEI. Other Borohemists that have one or more layers, with a combined thickness of 25 cm or more, consisting of sapric materials below the surface tier.  
**Sapric Borohemists**"

Page 220 and NSTH 615.62 p. 615-285, definition of Typic Borohemists change item 2. to read:

"2. Have:

- a. Less than 25 cm consisting of fibric materials below the surface tier; *and*"
- b. Less than 25 cm consisting of sapric materials below the surface tier;"

Page 222 and NSTH 615.62 p. 615-286 change item ACEC.1. (changed to ACGC.1.) to:

"1. One or more layers, with a combined thickness of 25 cm or more, consisting of fibric materials below the surface tier; *and*"

Change item ACED.1.(changed to ACGD.1. in NSTH 615.89) to:

"1. One or more layers, with a combined thickness of 25 cm or more, consisting of sapric materials below the surface tier; *and*"

Change item ACEH.(changed to ACGH. in NSTH 615.89) to:

"ACGH. Other Medihemists that have one or more layers, with a combined thickness of 25 cm or more, consisting of fibric materials below the surface tier.  
**Fibric Medihemists**"

And change item ACEI.(changed to ACGI. in NSTH 615.89) to:

"ACGI. Other Medihemists that have one or more layers, with a combined thickness of 25 cm or more, consisting of sapric materials below the surface tier.  
**Sapric Medihemists**"

Page 222 and NSTH 615.62 p. 615-286, definition of Typic Medihemists change item 2. to read:

"2. Have:

- a. Less than 25 cm consisting of fibric materials below the surface tier; *and*"
- b. Less than 25 cm consisting of sapric materials below the surface tier;"

Page 223 and NSTH 615.62 p. 615-287 change item ACEC.1. (changed to ACFC.1. in NSTH 615.89) to:

"1. One or more layers, with a combined thickness of 25 cm or more, consisting of fibric materials below the surface tier; *and*"

And change item ACED.1.(changed to ACFD.1. in NSTH 615.89) to:

"1. One or more layers, with a combined thickness of 25 cm or more, consisting of sapric materials below the surface tier; *and*"

Change item ACEH.(changed to ACFH. in NSTH 615.89) to:

"ACFH. Other Tropohemists that have one or more layers, with a combined thickness of 25 cm or more, consisting of fibric materials below the surface tier.  
**Fibric Tropohemists**"

Change item ACEI. (changed to ACFI. in NSTH 615.89) to:

"ACFI. Other Tropohemists that have one or more layers, with a combined thickness of 25 cm or more, consisting of sapric materials below the surface tier.  
**Sapric Tropohemists**"

Page 224 and NSTH 615.62 p. 615-287, definition of Typic Tropohemists change item 2. to read:

**"2. Have:**

- a. Less than 25 cm consisting of fibric materials below the surface tier; *and*"
- b. Less than 25 cm consisting of sapric materials below the surface tier;"

Change item ADBB.1.(changed to ADDB.1. in NSTH 615.89) to:

- "1. One or more layers, with a combined thickness of 12.5 cm or more, consisting of fibric materials below the surface tier; *and*"

Change item ADBC.1.(changed to ADDC.1. in NSTH 615.89) to:

- "1. One or more layers, with a combined thickness of 25 cm or more, consisting of hemic materials below the surface tier; *and*"

**Hemic Terric Borosapristis"**

Change item ADBG.(changed to ADDG. in NSTH 615.89) to:

"ADDG. Other Borosapristis that have one or more layers, with a combined thickness of 12.5 cm or more, consisting of fibric materials below the surface tier.

**Fibric Borosapristis"**

Change item ADBH.(changed to ADDH. in NSTH 615.89) to:

"ADDH. Other Borosapristis that have one or more layers, with a combined thickness of 25 cm or more, consisting of hemic materials below the surface tier.

**Hemic Borosapristis"**

Page 224 and NSTH 615.62 p. 615-288, definition of Typic Borosapristis change item 2. to read:

**"2. Have:**

- a. Less than 12.5 cm consisting of fibric materials below the surface tier; *and*"
- b. Less than 25 cm consisting of hemic materials below the surface tier;"

Page 226 and NSTH 615.62 p. 615-288 change item ~~ADDB.1. (changed in ADEB.1. in NSTH 615.89) to:~~

- "1. One or more layers, with a combined thickness of 12.5 cm or more, consisting of fibric materials below the surface tier; *and*"

Change item ADDC.1.(changed to ADFC.1. in NSTH 615.89) to:

- "1. One or more layers, with a combined thickness of 25 cm or more, consisting of hemic materials below the surface tier; *and*"

Change item ADDG.(changed to ADFG. in NSTH 615.89) to:

"ADFG. Other Medisapristis that have one or more layers, with a combined thickness of 12.5 cm or more, consisting of fibric materials below the surface tier.  
**Fibric Medisapristis"**

**"2. Have:**

- a. Less than 12.5 cm consisting of fibric materials below the surface tier; *and*"
- b. Less than 25 cm consisting of hemic materials below the surface tier;"

Page 226 and NSTH 615.62 p. 615-289 change item ACCB.1. (changed to ADEB.1. in NSTH 615.89) to:

- "1. One or more layers, with a combined thickness of 12.5 cm or more, consisting of fibric materials below the surface tier; *and*"

Change item ADCC.1.(changed to ADEC.1. in NSTH 615.89) to:

- "1. One or more layers, with a combined thickness of 12.5 cm or more, consisting of hemic materials below the surface tier; *and*"

Change item ADCG.(changed to ADEG. in NSTH 615.89) to:

"ADEG. Other Troposapristis that have one or more layers, with a combined thickness of 12.5 cm or more, consisting of fibric materials below the surface tier.  
**Fibric Troposapristis"**

Change item ADCH.(changed to ADEH. in NSTH 615.89) to:

"ADEH. Other Troposapristis that have one or more layers, with a combined thickness of 25 cm or more, consisting of hemic materials below the surface tier.  
**Hemic Troposapristis"**

Page 226 and NSTH 615.62 p. 615-289, definition of Typic Troposapristis change item 2. to read:

**"2. Have:**

- a. Less than 12.5 cm consisting of fibric materials below the surface tier; *and*"
- b. Less than 25 cm consisting of hemic materials below the surface tier;"

**615.124 Redoximorphic Concentrations**

Page 48 and NSTH 615.89 p. 615-425 Column 1 item 3. Redox concentrations change items (1) and (2) to read:

"(1) Nodules and concretions, i.e., cemented bodies that can be removed from the soil intact. Concretions are distinguished from nodules on the basis of internal organization. A concretion typically has concentric layers that are visible to the naked eye. Nodules do not have visible organized internal structure. Boundaries commonly are diffuse if formed *in situ* and sharp after pedonurbation;

(2) Masses are noncemented concentrations of substances within the matrix; *and*"

**615.125 Udollic Endoaqualfs**

The Udollic subgroup was inadvertently omitted from Endoaqualfs in NSTH 615.89.

a depth of 18 cm that meet these requirements after mixing; *and*

2. In one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, *one* of the following colors:

a. A hue of 7.5YR or redder in 50 percent or more of the matrix, *and*

(1) If peds are present, a chroma of 2 or more on 50 percent or more of ped exteriors, or no redox depletions with a chroma of 2 or less in ped interiors; *or*

(2) If peds are absent, a chroma of 2 or more in 50 percent or more of the matrix; *or*

b. In 50 percent or more of the matrix, a hue of 10YR or yellower *and either*

(1) Both a color value, moist, and chroma of 3 or more; *or*

(2) A chroma of 2 or more if there are no redox concentrations.

**Udolic Endoaqualfs"**

And renumber items IAJD. through IAJG. to IAJE. through IAJH.

**615.126 Addition of combination Vertic subgroups in the orders of Alfisols and Mollisols.**

The vertic subgroup as revised in NSTH issue 16 captures many fine montmorillonitic Alfisols and Mollisols. Some of these soils were in Aeric, Aquic, Aquollic, Cumulic, Fluvaquentic, and Mollic, or Udolic subgroups. To preserve these unique taxa Aeric Vertic, Aeric Chromic Vertic, Aquertic, Aquertic Chromic, Chromic Vertic, Cumulic Vertic, Fluvaquentic Vertic, and Oxyaquic Vertic, subgroups are added to selected great groups. In addition the aeric criteria used in the Udolic Epiqualf subgroup was inadvertently not updated the same in NSTH issue 16 as in the Aeric subgroup.

Page 110 and NSTH 615.61 p. 615-209 after item IAGA. add the following subgroups:

"IAGB. Other Albaqualfs which have *both* of the following:

1. *One or both:*

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower; *and*

2. A chroma of 3 or more in 40 percent or more of the matrix between the lower boundary of the A or Ap horizon and a depth of 75 cm from the mineral soil surface.

**Aeric Vertic Albaqualfs**

IAGC. Other Albaqualfs which have *both* of the following:

1. *One or both:*

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in

most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower; *and*

2. An Ap horizon or materials between the mineral soil surface and 18 cm that after mixing meet *one or more* the following colors;

a. A color value, moist, of 4 or more; *or*

b. A color value, dry, of 6 or more; *or*

c. A chroma of 4 or more.

**Chromic Vertic Albaqualfs"**

And renumber items IAGB. through IAGH. to IAGD. through IAGJ.

NSTH 615.89 p. 615-429 before item IAIA. add items:

"IAIA. Epiqualfs which have *all* of the following:

1. *One or both:*

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower; *and*

2. In one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, *one* of the following colors:

a. A hue of 7.5YR or redder in 50 percent or more of the matrix, *and*

(1) If peds are present, a chroma of 2 or more on 50 percent or more of ped exteriors, or no redox depletions with a chroma of 2 or less in ped interiors; *or*

(2) If peds are absent, a chroma of 2 or more in 50 percent or more of the matrix; *or*

b. In 50 percent or more of the matrix, a hue of 10YR or yellower *and either*

(1) Both a color value, moist, and chroma of 3 or more; *or*

(2) A chroma of 2 or more if there are no redox concentrations; *and*

3. An Ap horizon or materials between the mineral soil surface and 18 cm that after mixing meet *one or more* the following colors;

a. A color value, moist, of 4 or more; *or*

b. A color value, dry, of 6 or more; *or*

c. A chroma of 4 or more.

**Aeric Chromic Vertic Epiqualfs**

IAIB. Other Epiqualfs which have *both* of the following:

1. *One or both:*

- a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*
  - b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower; *and*
2. In one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, *one* of the following colors:
- a. A hue of 7.5YR or redder in 50 percent or more of the matrix. *and*

or no redox depletions with a chroma of 2 or less in ped interiors; *or*

(2) If peds are absent, a chroma of 2 or more in 50 percent or more of the matrix; *or*

b. In 50 percent or more of the matrix, a hue of 10YR or yellower *and either*

(1) Both a color value, moist, and chroma of 3 or more; *or*

(2) A chroma of 2 or more if there are no redox concentrations.

#### Udolic Epiaqualfs"

Add "Other" to item IAIA. and renumber items IAIA. through IAIE. to IAID. through IAII. and items IAIG. through IAII. to IAII. through IAII.

- (1) If peds are present, a chroma of 2 or more on 50 percent or more of ped exteriors, or no redox depletions with a chroma of 2 or less in ped interiors; *or*
  - (2) If peds are absent, a chroma of 2 or more in 50 percent or more of the matrix; *or*
- b. In 50 percent or more of the matrix, a hue of 10YR or yellower *and either*
- (1) Both a color value, moist, and chroma of 3 or more; *or*
  - (2) A chroma of 2 or more if there are no redox concentrations.

#### Aeric Vertic Epiaqualfs

IAIC. Other Epiaqualfs which have *both* of the following:

#### 1. One or both:

- a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the

Page 130 and NSTH 615.61 p. 615-222 (revised 615.90 p. 615-517) add following IEKB. new subgroup IEKC., change subgroup IEKC. to IEKD., and add new subgroups IEKE. and IEKF.:

"IEKC. Other Hapludalfs which have *all* of the following:

#### 1. One or both of the following:

- a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*
  - b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower; *and*
2. Redox depletions with a chroma of 2 or less in layers that also have aquic conditions in most years (or artificial drainage) *either*:
- a. Within the upper 25 cm of the argillic horizon if its upper boundary is within 50 cm of the

- b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower; *and*

2. An Ap horizon or materials between the mineral soil surface and 18 cm that after mixing meet *one or more* of the following colors:

- b. Within 75 cm of the mineral soil surface if the upper boundary of the argillic horizon is 50 cm or more below the mineral soil surface; *and*

3. An Ap horizon or materials between the mineral soil surface and 18 cm that after mixing meet *one or more* of the following colors:

depth of 100 cm or a lithic or paralithic contact, whichever is shallower.

**Oxyaquic Vertic Hapludalfs**

IEKF. Other Hapludalfs which have *both*

1. *One or both* of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower; *and*

2. An Ap horizon or materials between the mineral soil surface and 18 cm that after mixing meet *one or more* the following colors;

a. A color value, moist, of 4 or more; *or*

b. A color value, dry, of 6 or more; *or*

c. A chroma of 4 or more.

**Chromic Vertic Hapludalfs**

And renumber items IEKD. through IEKW. to IEKG. through IEKZ.

Page 139 and NSTH 615.90 p. 615-518. After item ICHA. add items ICHB. and ICHC.;

"ICHB. Other Hapludalfs which have *both*:

1. *One or both* of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower; *and*

2. In one or more horizons within 75 cm of the soil mineral surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquertic Hapludalfs**

IHCC. Other Hapludalfs that have *both*:

1. *One or both* of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower; *and*

2. Saturation with water, in one or more layers within 100 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years.

**Oxyaquic Vertic Hapludalfs**

And renumber items ICHB. through ICHO. to ICHD. through ICHQ.

Page 143 and NSTH 615.90 p. 615-519. Before item ICFA. add items ICFA. and ICFB.:

"ICHA. Paleustalfs which have *both*:

1. *One or both* of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower; *and*

2. In one or more horizons within 75 cm of the soil mineral surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquertic Paleustalfs**

IHCB. Other Paleustalfs that have *both*:

1. *One or both* of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower, saturation with water, in one or more layers within 100 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years; *and*

2. Saturation with water, in one or more layers within 100 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years.

**Oxyaquic Vertic Paleustalfs**

And add "Other" to item ICFA. and renumber items ICFA. through ICFR. to ICFC. through ICFT.

NSTH 615.89 p. 615-489 and 490 after item HBGA. add:

"HBGB. Other Endoaquolls which have *both*:

1. *One or both* of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower; *and*

2. A mollic epipedon 60 cm or more thick.

**Cumulic Vertic Endoaquolls**

HBGC. Other Endoaquolls which have *all* of the following:

1. *One or both* of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in

most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower; *and*

2. *Either* 0.3 percent or more organic carbon in all

aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower; *and*

2. In one or more horizons within 100 cm of the mineral soil surface: redox depletions with a chroma

1. An upper boundary within 125 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower; *and*

2. A base saturation (by sum of cations) of less than 35 percent throughout the upper 50 cm or the entire argillic horizon, if it is less than 50 cm thick.

**Ultic Haplustands"**

and renumber items CFBJ. through CFBL. to CFBK. to CFBL. through CFBM.

NSTH 615.60 p. 615-203 Column 1 Add, after item CDAC. Thaptic Vitrixerands add item:

"CDAD. Other Vitrixerands which have an argillic or a kandic horizon that has *both*:

1. An upper boundary within 125 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower; *and*

2. A base saturation (by sum of cations) of less than 35 percent throughout the upper 50 cm or the entire argillic horizon, if it is less than 50 cm thick.

**Ultic Vitrixerands"**

And renumber items CDAD. through CDAG. to CDAE. through CDAH. respectively.

**615.128 Revisions to Entic and Torriorthentic subgroups of Mollisols**

The criteria for these subgroups, with regard to the lower part of the mollic epipedon were unclear. The intent of these subgroups is to include soils that do not have a cambic horizon and that do not have part of the mollic epipedon in the position (below 25 cm) of a cambic horizon that fails to be a cambic horizon only because of color, unless either the cambic horizon or that part of the mollic epipedon below 25 cm is sandy or has free carbonates throughout.

Page 297 and NSTH 615.62 p. 615-330, left column, change item HGDJ. (changed to HGEM. in 615.84 and 615.89 p. 615-405 and 615-495) Entic Hapludolls to read:

"HGEM. Other Hapludolls that: *either*

1. Do not have a cambic horizon *and* do not, in any part of the mollic epipedon below 25 cm from the mineral soil surface, meet all the requirements for a cambic horizon except color; *or*

2. Have free carbonates throughout the cambic horizon *or* all parts of the mollic epipedon below a depth of 25 cm from the mineral soil surface.

**Entic Hapludolls"**

2. Have free carbonates throughout the cambic horizon *or* all parts of the mollic epipedon below a depth of 25 cm from the mineral soil surface.

**Torriorthentic Haplustolls"**

Page 304 and NSTH 615.62 p. 615-339, column 2 change item GEGX. (changed to HFGY. in 615.106 and 615.89 p. 615-601 and 615-495) Entic Haplustolls to read:

"HFGY. Other Haplustolls that: *either*

1. Do not have a cambic horizon *and* do not, in any part of the mollic epipedon below 25 cm from the mineral soil surface, meet all the requirements for a cambic horizon except color; *or*

2. Have free carbonates throughout the cambic horizon *or* all parts of the mollic epipedon below a depth of 25 cm from the mineral soil surface.

**Entic Haplustolls"**

Page 304 and NSTH 615.62 p. 615-340, definition of Typic Haplustolls, replace item 4. with the following:

"4. Have a cambic horizon that does not have free carbonates throughout, *or* have in some part of the mollic epipedon, below 25 cm from the mineral soil surface, all of the requirements for a cambic horizon except color, *and* no free carbonates;

NSTH 615.62 p. 615-350, column 1 change item HDFT. 2. (changed to HDFU. 2. in 615.89 p. 615-499) Torriorthentic Haploxerolls to read:

"2. *Either*:

1. Do not have a cambic horizon *and* do not, in any part of the mollic epipedon below 25 cm from the mineral soil surface, meet all the requirements for a cambic horizon except color; *or*

2. Have free carbonates throughout the cambic horizon *or* all parts of the mollic epipedon below a depth of 25 cm from the mineral soil surface.

**Torriorthentic Haploxerolls"**

Page 316 and NSTH 615.62 p. 615-350, column 2 change item HDFZb. (changed to HDFZc. in 615.89 p. 615-499) Entic Haploxerolls to read:

"HDFZc. Other Haploxerolls that: *either*

1. Do not have a cambic horizon *and* do not, in any part of the mollic epipedon below 25 cm from the mineral soil surface, meet the requirements for a cambic horizon except color; *or*

2. Have free carbonates throughout the cambic horizon *or* all parts of the mollic epipedon below a

The following changes are needed to implement this proposal:

Page 286 and NSTH 615.62 p. 615-321 following item HEBM. (changed to HEBN) Add:

"HEBO. Other Cryoborolls which have:

1. A mollic epipedon 40 cm or more thick with a texture finer than loamy fine sand; *and*
2. An irregular decrease in organic-carbon content from a depth of 25 cm below the mineral soil surface to a depth of 125 cm, or to a lithic or paralithic contact if shallower; *and*
3. A slope of less than 25 percent; *and*
4. In one or more horizons within 100 cm of the mineral soil surface, distinct or prominent redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Cumulic Cryoborolls"**

And renumber items HEBO. through HEBZa. to HEBP. through HEBZb.

Page 289 and NSTH 615.62 p. 615-323 following item

c. A hue of 2.5Y or yellower and a chroma of 3 or less.

**Aquic Cumulic Hapludolls"**

And renumber items HGEF. through HGEN. to HGEH. through HGEO.;

Page 304 and NSTH 615.62 p. 615-338 following HFGL. (changed to HFGK.) add:

"HFGL. Other Haplustolls which have:

1. A mollic epipedon 50 cm or more thick with a texture finer than loamy fine sand; *and*
2. An irregular decrease in organic-carbon content from a depth of 25 cm below the mineral soil surface to a depth of 125 cm, or to a lithic or paralithic contact if shallower; *and*
3. A slope of less than 25 percent; *and*
4. In one or more horizons within 100 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage).

**Aquic Cumulic Haplustolls"**

And renumber items EABB. through EABE. to EABC. through EABF.

NSTH 615.90 p. 615-551 column 2, Definition of Typic Duraquerts after item 3. add:

4. Do not have both a thermic, mesic, or frigid soil temperature regime and, if not irrigated during the year, have cracks in 6 or more out of 10 years that remain *both*:

a. Five mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 60 or more consecutive days during the 90 days following the summer solstice; *and*

b. Closed for 60 or more consecutive days during the 90 days following the winter solstice.

#### 615.131 Lithic Endoaquods

No lithic subgroup was provided in Endoaquods. Aquods with a water table perched on a lithic contact are Endoaquods. A lithic subgroup is added to Endoaquods.

NSTH 615.91 p. 615-581 Before item BAGA. add:

"BAGA. Endoaquods that have a lithic contact within 50 cm of the mineral soil surface.

#### **Lithic Endoaquods"**

Add "Other" at the beginning of BAGA. and renumber items BAGA. through BAGE. to BAGB. through BAGF.

NSTH 615.91 p. 615-581 Definition of Typic Endoaquods After item 3. add:

4. Do not have a lithic contact within 50 cm of the mineral soil surface.

#### 615.132 Entic and Aquentic subgroups of Fragiorthods and Haplorthods

(2) A weighted average of 1.24percent or more organic carbon; *or*

(3) Within the upper 7.54cm, either or both a moist color value or chroma of 3 or less (crushed and smoothed sample); *or*

b. A texture of loamy fine sand, fine sand, or coarser *and both*, a moist color value *and* chroma of 3 or less (crushed and smoothed sample) in the upper 2.54cm.

NSTH 615.91 p. 615-589 Change item BDEA. to read:

"BDEA. Haplorthods which have a lithic contact within 50 cm of the mineral soil surface; *and either*

1. A spodic horizon with a texture of very fine sand, loamy very fine sand, or finer: *and*

a. A thickness of 104cm or less; *and*

b. A weighted average of less than 1.24percent organic carbon; *and*

c. Within the upper 7.54cm, *either or both* a moist color value *or* chroma of 4 or more (crushed and smoothed sample); *or*

2. A spodic horizon with a texture of loamy fine sand, fine sand, or coarser *and either or both*, a moist color value *or* chroma of 4 or more (crushed and smoothed sample) in the upper 2.54cm.

#### **Entic Lithic Haplorthods"**

NSTH 615.91 p. 615-590. Change item BDED. to read:

"BDED. Other Haplorthods which have in one or more horizons within 75 cm of the mineral soil surface, redoximorphic features, and also aquic conditions for some time in most years (or artificial drainage); *and either*

1. A spodic horizon that has a texture of very fine sand, loamy very fine sand, or finer: *and*

2. A texture of loamy fine sand, fine sand, or coarser and *either or both*, a moist color value or chroma of 4 or more (crushed and smoothed sample) in the upper 2.54cm.

**Entic Haplorthods<sup>1</sup>**

NSTH 615.91 p. 615-589 definition of Typic Haplorthods change item 6. to read:

6. Have a spodic horizon that has *one or more* of the following:

a. A texture of very fine sand, loamy very fine sand, or finer; *and*

(1) A thickness of more than 104cm; *or*

(2). A weighted average of 1.24percent or more organic carbon; *or*

(3) Within the upper 7.54cm, *either or both* a moist color value or chroma of 3 or less (crushed and smoothed sample); *or*

b. A texture of loamy fine sand, fine sand, or coarser *and both*, a moist color value *and* chroma of 3 or less (crushed and smoothed sample) in the upper 2.54cm.

**615.133 Key to the Orders and suborders of Histosols**

The following changes are made to solve problems in the key to the suborders of Histosols. Using the former version of the Key some Histosols which are never saturated with water except for a few days following heavy rains classify as Sapristis. Also the wording of the last phrase of item A.2.a. in the Key to the Orders could be interpreted to include layers of fragmental materials or of organic materials greater than 40 cm thick. The intent is to only include soils that have both an organic layer and a fragmental layer.

Page 92, Key to orders item A.2.a. (refer to NSTH 615.91). Change items A.2.a. and A.2.b. to read:

**"A. Soils which:**

1. Do not have andic soil properties in 60 percent or more of the thickness between the soil surface and either a depth of 60 cm, or a lithic or paralithic contact or duripan if shallower; *and*

2. Have organic soil materials that meet *one or more* of the following:

a. Overlie cindery, fragmental, or pumiceous materials and/or fill their interstices<sup>1</sup>, *and* directly below these materials either a lithic or paralithic contact; *or*

b. When added with underlying cindery, fragmental, or pumiceous materials total 40 cm or more between the soil surface and a depth of 50 cm; *or*

c. Constitute two thirds or more of the total thickness of the soil to a lithic or paralithic contact *and* mineral soil layers which, if present, have a total thickness of 10 cm or less; *or*

d. Are saturated with water for 6 months or more per year in most years (or artificially drained), and have an upper boundary within 40 cm of the soil surface, and have a total thickness of *either*:

(1) 60 cm or more if three fourths or more of the volume consists of moss fibers, *or* if the

bulk density, moist, is less than 0.1 g/cm<sup>3</sup>; *or*

(2) 40 cm or more if they consist *either* of sapric or hemic materials, or of fibric materials with less than three fourths (by volume) moss fibers *and* a bulk density, moist, of 0.1 g/cm<sup>3</sup> or more.

**Histosols, p.**

Page 212, column 1 Replace entire key to suborders with:

**"KEY TO SUBORDERS**

AA. Histosols which are never saturated with water except for a few days following heavy rains, *and* which have *both*:

1. A lithic or paralithic contact within 100 cm of the soil surface, *and/or* a thickness of organic plus cindery, fragmental, or pumiceous materials totaling 40 cm or more between the soil surface and a depth of 50 cm; *and*

2. Organic soil materials, that are, by weighted average, less than three fourths (by volume) *Sphagnum* fibers.

**Folists, p.**

AB. Other Histosols which *either*:

1. Have more thickness of fibric soil materials than any other kind of organic soil material; *either*

a. In the organic parts of the subsurface tier if there is no continuous mineral layer 40 cm or more thick that has its upper boundary within the subsurface tier; *or*

b. In the *combined* thickness of the organic parts of the surface *and* subsurface tiers if there is a continuous mineral layer 40 cm or more thick that has its upper boundary within the subsurface tier; *or*

2. Are organic soil materials, that are, by weighted average, three fourths or more by volume, *Sphagnum* fibers and which rest on a lithic or paralithic contact, fragmental materials, or on organic materials frozen 2 months after the summer solstice.

**Fibrists, p.**

AC. Other Histosols that have more thickness of hemic soil materials than any other kind of organic soil materials *either*:

1. In the organic parts of the subsurface tier if there is no continuous mineral layer 40 cm or more thick that has its upper boundary within the subsurface tier; *or*

2. In the *combined* thickness of the organic parts of the surface *and* subsurface tiers if there is a continuous mineral layer 40 cm or more thick that has its upper boundary within the subsurface tier.

**Hemists, p.**

AD. Other Histosols.

**Sapristis, p."**

**615.134 Family differentiae for Histosols**

Page 390 right column delete entire section "Soil depth classes" and insert the following:

**"Soil depth classes**

Soil depth classes refer to the depth to a lithic, paralithic, or petroferric contact, or to cindery,

<sup>1</sup> Materials that meet the definition of cindery, fragmental, or pumiceous except have more than 10 percent (by volume) voids that are filled with organic soil materials are considered as organic soil materials.

fragmental, or pumiceous material. The following two soil depth modifiers are used for families in all subgroups of Histosols, except that the shallow class is not used in the suborder of Folists:

**Shallow.**--Between 18 and 50 cm from the soil surface.

**Micro.**--At a depth less than 18 cm from the soil surface."

#### 615.135 Addition of Typic Subgroups

Page 111, second column, following the paragraph on Duraqualfs add:

"Key to subgroups  
IABA. All Duraqualfs (provisionally).  
**Typic Duraqualfs**"

Page 117, second column, following the definition of Plinthaqualfs add:

"Key to subgroups  
IAAA. All Plinthaqualfs (provisionally).  
**Typic Plinthaqualfs**"

Page 124, first column, following the paragraph on Natriboralfs add:

"Key to subgroups  
IBCA. All Natriboralfs (provisionally).  
**Typic Natriboralfs**"

Page 125, second column, following the paragraphs on Agrudalfs add:

"Key to subgroups  
IEAA. All Agrudalfs (provisionally).  
**Typic Agrudalfs**"

Page 136, first column, following the paragraph on Rhodudalfs add:

"Key to subgroups  
IEJA. All Rhodudalfs (provisionally).  
**Typic Rhodudalfs**"

Page 138, first column, following the paragraph on Durustalfs add:

"Key to subgroups  
ICAA. All Durustalfs (provisionally).  
**Typic Durustalfs**"

Page 145, second column, following the paragraph on Plinthustalfs add:

"Key to subgroups  
ICBA. All Plinthustalfs (provisionally).  
**Typic Plinthustalfs**"

Page 153, first column, following the paragraph on Plinthoxeralfs add:

"Key to subgroups  
IDDA. All Plinthoxeralfs (provisionally).  
**Typic Plinthoxeralfs**"

Page 214, second column, following the paragraph on Luvifibrists add:

"Key to subgroups  
ABEA. All Luvifibrists (provisionally).  
**Typic Luvifibrists**"

Page 221, second column, following the paragraph on Luvihemists add:

"Key to subgroups  
ACCA. All Luvihemists (provisionally).  
**Typic Luvihemists**"

Page 245, first column, following the paragraph on Plinthaquepts add:

"Key to subgroups  
JAFA. All Plinthaquepts (provisionally).  
**Typic Plinthaquepts**"

Page 257, second column, following the paragraph on Plaggepts add:

"Key to subgroups  
JBA. All Plaggepts (provisionally).  
**Typic Plaggepts**"

Page 262, second column, following the paragraph on Sombristroepts add:

"Key to subgroups  
JCBA. All Sombristroepts (provisionally).  
**Typic Sombristroepts**"

Page 358, second column, following the paragraph on Plinthohumults add:

"Key to subgroups  
GBBA. All Plinthohumults (provisionally).  
**Typic Plinthohumults**"

Page 358, second column, following the paragraph on Sombrihumults add:

"Key to subgroups  
GBAA. All Sombrihumults (provisionally).  
**Typic Sombrihumults**"

Page 366, second column, following the definition of Plinthudults add:

"Key to subgroups  
GCBA. All Plinthudults (provisionally).  
**Typic Plinthudults**"

Page 371, second column, following the paragraph on Plinthustults add:

"Key to subgroups  
GDAA. All Plinthustults (provisionally).  
**Typic Plinthustults**"

Page 373, second column, following the definition of Palexerults add:

"Key to subgroups  
GEAA. All Palexerults (provisionally).  
**Typic Palexerults**"

#### 615.136 Table 7, additions and deletions

The following changes required in table 7 result from implementing the recommendations from International Committee on Aridisols, (ICOMID).

Page 86 Table 7. Delete the suborder "Orthids" and all great groups of Orthids; and delete the following great groups of Argids; "Durargids" and "Nadurargids".

Add the following suborders and great groups in the order Aridisols:

Before Haplargids add:

"Calciargids  
Gypsiargids"

And following Paleargids add:

Petroargids

Following Argids add:

"Calcids

Haplocalcids

Petrocalcids

Cambids

Anthracambids

Aquicambids

Haplocambids

Petrocambids

Cryids  
 Argicryids  
 Calcicryids  
 Gypsicryids  
 Haplocryids  
 Petrocryids  
 Salicryids  
 Durids  
 Argidurids  
 Haplodurids  
 Natridurids  
 Gypsids  
 Argigypsids  
 Calcigypsids  
 Haplogypsids  
 Natrigypsids  
 Petrogypsids  
 Salids  
 Aquisalids  
 Haplosalids"

## 615.137 Corrections and clarifications

NSTH 615.89 p. 615-427 (and p. 96 and 109) item IA.  
 1.b: "chroma or 2" should be "chroma of 2"

NSTH 615.89 p. 615-449 item BAFA. (changed to CAFA.  
 in NSTH 615.91) delete word "Other"

The criteria for vitric subgroups of Andisols should have used both dried and undried 1500 kPa water content. The dried content was inadvertently omitted in the NSTH 615.60 and the word "or" was omitted between "25 cm" and "more".

NSTH 615.60 p. 615-176 left column Andic Soil Properties, delete footnote 2/ and insert text of the footnote into the description of Andic Soil Properties.

615.60 p. 615-206 delete the terms "glass aggregates, glass-coated grains, and other vitric volcanoclastics" from the definition of "ashy".

NSTH 615.60 p. 615-185 item BBCB. (changed to CBCB. in NSTH 615.91). replace the first 4 lines of the criteria with the following:

"CBCB. Other Fulvicryands that have 1500 kPa water retention of less than 15 percent on air-dried samples *or* of less than 30 percent on undried samples throughout one or more layers with andic soil properties that have a total thickness of 25 cm or more within 100 cm"

NSTH 615.60 p. 615-186 item BBFE. (changed to CBFE. in NSTH 615.91). replace the first 4 lines of the criteria with the following:

"CBFE. Other Haplocryands that have 1500 kPa water retention of less than 15 percent on air-dried samples *or* of less than 30 percent on undried samples throughout one or more layers with andic soil properties that have a total thickness of 25 cm or more within 100 cm"

NSTH 615.60 p. 615-187 item BBBC. (changed to CBBC. in NSTH 615.91). replace the first 4 lines of the criteria with the following:

"CBBC. Other Melanocryands that have 1500 kPa

water retention of less than 15 percent on air-dried samples *or* of less than 30 percent on undried samples throughout one or more layers with andic soil properties

total thickness of 25 cm or more within 100 cm either of"

NSTH 615.60 p. 615-195 item BGCG. (changed to CGCH. in NSTH 615.91). replace the first 4 lines of the criteria in item 2. with the following:

"2. A 1500 kPa water retention of less than 15 percent on air-dried samples *or* of less than 30 percent on undried samples throughout one or more layers with andic soil properties that have a total thickness of 25 cm or more within 100 cm either of"

NSTH 615.60 p. 615-196 item BGCL. (changed to CGCK. in NSTH 615.91). replace the first 4 lines of the criteria in item 2. with the following:

"2. A 1500 kPa water retention of less than 15 percent on air-dried samples *or* of less than 30 percent on undried samples throughout one or more layers with andic soil properties that have a total thickness of 25 cm or more within 100 cm either of"

NSTH 615.60 p. 615-195 item BGCK. (changed to CGCL. in NSTH 615.91). replace the first 4 lines of the criteria in item 2. with the following:

"2. A 1500 kPa water retention of less than 15 percent on air-dried samples *or* of less than 30 percent on undried samples throughout one or more layers with andic soil properties that have a total thickness of 25 cm or more within 100 cm either of"

NSTH 615.60 p. 615-196 item BGCL. (changed to CGCM. in NSTH 615.91 and name corrected). replace the first 4 lines with the following:

"CGCM. Other Melanudands which have 1500 kPa water retention of less than 15 percent on air-dried samples *or* of less than 30 percent on undried samples throughout one or more layers with andic soil properties that have a total thickness of 25 cm or more within 100 cm"

NSTH 615.60 p. 615-197 item BGAE. (changed to CGAE. in NSTH 615.91). replace the first 4 lines of the criteria in item 2. with the following:

"2. A 1500 kPa water retention of less than 15 percent on air-dried samples *or* of less than 30 percent on undried samples throughout one or more layers with andic soil properties that have a total thickness of 25 cm or more within 100 cm either of"

NSTH 615.60 p. 615-196 item BGAF. (changed to CGAF. in NSTH 615.91) replace the first 4 lines with the following:

"CGAF. Other Placudands which have 1500 kPa water retention of less than 15 percent on air-dried samples *or* of less than 30 percent on undried samples throughout one or more layers with andic soil properties that have a total thickness of 25 cm or more within 100 cm either of"

NSTH 615.60 p. 615-199 item BFBC. (changed to CFBC. in NSTH 615.91) replace the first 4 lines of the criteria in item 2. with the following:

"2. A 1500 kPa water retention of less than 15 percent on air-dried samples *or* of less than 30 percent on undried samples throughout one or more layers with andic soil properties that have a total thickness of 25 cm or more within 100 cm either of"

total thickness of 25 cm or more within 100 cm either of"

NSTH 615.45 p. 615-123 item CC. (changed to DC. in NSTH 615.60) Correct to read:

"DC. Other Oxisols that have an ustic or xeric moisture regime.

Ustox p. 432"

NSTH 615.91 p. 615-587 correct item "BDDD. Grossarenic Entic Alorthods" to "BDDD. Entic Grossarenic Alorthods" by our naming conventions multiple subgroup names are in alphabetical order.

NSTH 615.89 p 615-508 item GAHD. "Epiaquults" should be "Other Epiaquults"

NSTH 615.90 p 615-564 item EEED. Petrocalcic Haplusterts; correct "100 cm" to "150 cm".

The criteria for Dystric Eutrochrepts and the Dystric part of the Aquic Dystric Eutrochrepts and Dystric Fluventic Eutrochrepts subgroups have been changed inadvertently by the reformatting of the subgroups. The original criterion from Soil Taxonomy page 251 is the inverse of "d. Have carbonates within a depth of 1 meter in some part of each pedon;"

Page 251 and NSTH 615.62 p. 615-300 item JDFG.2. (changed to JDGH.2. in NSTH 615.89, p. 615-481): correct to read:

"2. Do not have free carbonates throughout any horizon within 100 cm of the mineral soil surface; *and*"

Page 251 and NSTH 615.62 p. 615-300 item JDFI.1. (changed to JDGK.1. in NSTH 615.89, p. 615-481): correct to read:

"1. Do not have free carbonates throughout any horizon within 100 cm of the mineral soil surface; *and*"

Page 251 and NSTH 615.62 p. 615-300 item JDFL. (changed to JDGN. in NSTH 615.89, p. 615-481): correct to read:

"JDGN. Other Eutrochrepts that do not have free carbonates throughout any horizon within 100 cm of the mineral soil surface."

Page 218 and NSTH 615.100 p. 615-597 and Soil Taxonomy p. 218; When the "Key to great groups" of Folists was amended adding "Medifolists" item AAB. should have been amended as follows:

"AAB. Other Folists that have an isomesic or warmer iso temperature regime."

When the criteria for some "aquic" suborders were written they were constructed in such a manner that soils with a lithic or paralithic contact at a depth of less than 40 cm below the mineral soil could not be met. The intent of the criteria are to include such soils in "aquic" suborders, but to exclude deeper soils that have aquic conditions only in layers above a depth of 40 cm.

The following are needed to correct this error:

NSTH 615.89 p. 615-448 item BA.2. (changed to CA.2. in NSTH 615.91) replace the first paragraph with the following:

2. In a layer above a lithic or paralithic contact or in a layer between 40 and 50 cm either from the mineral soil surface or from the top of an organic layer with andic soil properties, whichever is shallowest, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

NSTH 615.89 p. 615-448 Aquands, definition item 2. Replace the first paragraph with the following:

2. In a layer above a lithic or paralithic contact or in a layer between 40 and 50 cm either from the mineral soil

surface or from the top of an organic layer with andic soil properties, whichever is shallowest, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

NSTH 615.89 p. 615-460 item KA.3. replace the first paragraph with the following:

3. In a layer above a lithic or paralithic contact or in a layer between 40 and 50 cm from the mineral soil surface, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

NSTH 615.89 p. 615-461 Aquents, definition item 3. Replace the first paragraph with the following:

3. In a layer above a lithic or paralithic contact or in a layer between 40 and 50 cm from the mineral soil surface, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

NSTH 615.89 p. 615-474 item JA.1. replace the first paragraph with the following:

1. In a layer above a lithic or paralithic contact or in a layer between 40 and 50 cm from the mineral soil surface, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

NSTH 615.89 p. 615-475 Aquepts, definition item 1. Replace the first paragraph with the following:

2. In a layer above a lithic or paralithic contact or in a layer between 40 and 50 cm from the mineral soil surface, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

NSTH 615.89 p. 615-486 item HB. replace the first paragraph with the following:

1. Other Mollisols that have in a layer above a lithic or paralithic contact or in a layer between 40 and 50 cm from the mineral soil surface, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

NSTH 615.89 p. 615-475 Aquolls, definition, Replace the first paragraph with the following:

2. Aquolls are the Mollisols that have in a layer above a lithic or paralithic contact or in a layer between 40 and 50 cm from the mineral soil surface, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

The Key to the orders was changed in NSTH 615.91. Soils with a thickness of less than 35 cm of andic soil materials are keyed into the order of Andisols if the thickness of andic soil materials is more than 60 percent of the thickness between either the mineral soil surface or the top of an organic layer with andic soil properties, whichever is shallower, and a lithic or paralithic contact, duripan or petrocalcic horizon. When this change was made no provisions were made to allow these thin Andisols into the suborder of Vitrandis and some great groups of Cryands, Xerands, and Udands. To correct this omission the following changes are needed.

NSTH 615.60 p. 615-180 change item BE. (Changed to CE. in NSTH 615.91) to the following:

"CE. Other Andisols that have a 1500-kPa water retention of less than 15 percent on air-dried samples *and* of less than 30 percent on undried samples, throughout 60 percent or more of the thickness *either*:

1. Within 60 cm either of the mineral soil surface, or of the top of an organic layer with andic soil

properties, whichever is shallower, if there is no lithic or paralithic contact, duripan, or petrocalcic horizon within that depth; *or*

2. Between either the mineral soil surface, or the top of an organic layer with andic soil properties, whichever is shallower, and a lithic or paralithic contact, duripan, or petrocalcic horizon.

**Vitrands"**

NSTH 615.60 p. 615-181 change item BAD. (Changed to CAD. in NSTH 615.91) to the following:

"CAD. Other Aquands that have a 1500-kPa water retention of less than 15 percent on air-dried samples *and* of less than 30 percent on undried samples, throughout 60 percent or more of the thickness *either*:

1. Within 60 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower, if there is no lithic or paralithic contact, duripan, or petrocalcic horizon within that depth; *or*

2. Between either the mineral soil surface, or the top of an organic layer with andic soil properties, whichever is shallower, and a lithic or paralithic contact, duripan, or petrocalcic horizon.

**Vitraquands"**

NSTH 615.60 p. 615-184 Definition of Vitraquands, change item 1. to the following:

"1. Have a 1500-kPa water retention of less than 15 percent on air-dried samples *and* of less than 30 percent on undried samples, throughout 60 percent or more of the thickness *either*:

a. Within 60 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower, if there is no lithic or paralithic contact, duripan, or petrocalcic horizon within that depth; *or*

2. Between either the mineral soil surface, or the top of an organic layer with andic soil properties, whichever is shallower, and a lithic or paralithic contact, duripan, or petrocalcic horizon.

**Vitricryands"**

NSTH 615.60 p. 615-186 Definition of Hydrocryands, change item 3. to the following:

"3. Have, undried, a 1500-kPa water retention of 100 percent or more, on the weighted average, throughout *either*:

a. One or more layers with a total thickness of 35 cm between the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower, and 100 cm from the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower, if there is no lithic or paralithic contact, duripan, or petrocalcic horizon within that depth; *or*

b. 60 percent or more of the thickness between either the mineral soil surface, or the top of an organic layer with andic soil properties, whichever is shallower, and a lithic or paralithic contact, duripan, or petrocalcic horizon.

NSTH 615.60 p. 615-187 Definition of Vitricryands, change item 3. to the following:

"3. Have a 1500-kPa water retention of less than 15 percent on air-dried samples *and* of less than 30 percent on undried samples, throughout 60 percent or more of the thickness *either*:

a. Within 60 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower, if there is no lithic or paralithic contact, duripan, or petrocalcic horizon within that depth; *or*

paralithic contact, duripan, or petrocalcic horizon within that depth; *or*

b. 60 percent or more of the thickness between either the mineral soil surface, or the top of an organic layer with andic soil properties, whichever is shallower, and a lithic or paralithic contact, duripan, or petrocalcic horizon."

NSTH 615.60 p. 615-200 Definition of Vitrandis, change item 4. to the following:

"4. Have a 1500-kPa water retention of less than 15 percent on air-dried samples *and* of less than 30 percent on undried samples, throughout 60 percent or more of the thickness *either*:

a. Within 60 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower, if there is no lithic or paralithic contact, duripan, or petrocalcic horizon within that depth; *or*

b. Between either the mineral soil surface, or the top of an organic layer with andic soil properties, whichever is shallower, and a lithic or paralithic contact, duripan, or petrocalcic horizon."

NSTH 615.62 p. 615-320 Move item HEBD. to follow item HEBA. and change the number to HEBB. and renumber the items HEBB. and HEBC. to HEBC. and HEBD.: